2015 Greene County Natural Hazard Mitigation Plan

Massive F5 tornado rips across on Xenia, Ohio, April 3, 1974 (photo by Fred Stewart, NOAA).

Table of Contents

Chapter 1 Introduction

The mission of the Greene County Natural Emergency Mitigation Planning Team is *to create a comprehensive research-based hazard mitigation plan to reduce the risk, damage to life and property, and public cost to Greene County communities, agencies, businesses and natural resources caused from the effects of natural hazards like earthquake, wind, rain, flood, hail, snow and heat.*

Introduction

Greene County is one of the most rapidly growing counties in the State of Ohio and is subject to flooding, hail, earthquakes, severe winter storms, and tornados or windstorms. It is impossible to predict exactly when these disasters will occur, or the extent to which they will affect the county's 161,573 residents, but with careful planning, it is possible to minimize the losses that could result from natural disasters.

Greene County most recently experienced large-scale economic losses during "Dry Ike," a severe wind storm resulting from the tropical depression "Ike" in September of 2008. The storm directly or indirectly affected all of the county's residents, when consistent winds of 55 mph with gusts 75 mph caused a widespread power outages and downed trees which resulted in power outages that lasted for several weeks.

Greene County was one of thirty-three counties that sought and received a Presidential Disaster Declaration to obtain federal assistance for its recovery efforts. Greene County was reimbursed 75% of eligible costs for Public Assistance from this declaration. The cost of recovery from this wind storm was estimated at approximately $53 million for the counties eligible for federal reimbursement.

Purpose: Why Does Greene County Need this Plan?

Mitigation is the cornerstone of emergency management. It's the ongoing effort to lessen the impact disasters have on people's lives and property though damage prevention and flood insurance. Through measures such as building safety within the floodplain or removing homes altogether; engineering building and infrastructures to withstand earthquakes and creating and enforcing effective building codes to protect property from floods, hurricanes and other natural hazards, the impact on lives and communities is lessened.[1]

[1] http://www.fema.gov/about/divisions/mitigation/shtm

A Mitigation Plan is a plan that identifies mitigation priorities and projects for all communities within the county. The need for a county mitigation plan came to light following an amendment to the Stafford Act in February of 2002. It mandated that after November 1, 2003, a local government must have a mitigation plan on file with the State in order to receive mitigation funding for any declared disaster.

Communities have the option to either adopt, through resolution, the countywide plan or create their own independent plan. A natural hazard mitigation plan sets the ground work for communities to reduce their risk from natural hazards by identifying resources, information, and strategies for risk reduction. While the plan helps to coordinate mitigation activities throughout the county.

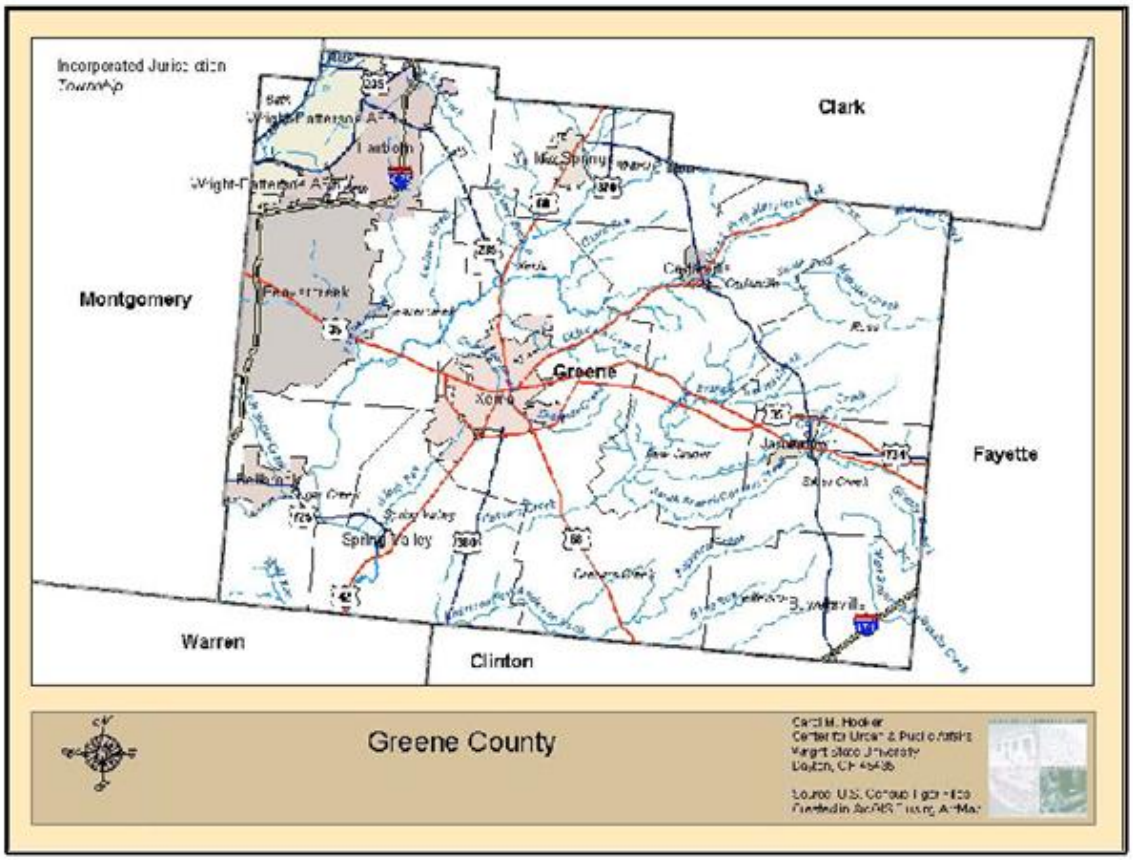
Greene County Emergency Management Agency partnered with Wright State University in 2004 for the completion of a County wide Comprehensive natural Hazard Mitigation Plan. In order to create this comprehensive plan, a hazard analysis was completed that identified natural risks threatening each political jurisdiction within the county. This hazard analysis is the foundation upon which all emergency planning efforts in the community are built and provides an understanding of potential threats facing the communities.

The Plan identifies the hazards threatening jurisdiction within Greene County and provides an assessment of the vulnerability to those hazards. This plan was originally prepared in 2004, and has been updated to include events and changes through 2013.

The plan provides a set of action items to reduce risk from natural disasters through education and outreach programs, to develop partnerships, and to implement preventative projects. The information within the Mitigation Plan: (1) establishes the foundation for coordination and collaboration among agencies and the public in Greene County; (2) identifies and prioritizes future mitigation projects; and (3) assists in meeting the requirements of federal assistance programs. The mitigation plan is developed in conjunction with other jurisdictional plans and is not designed as a stand-alone plan.

The Greene County Natural Hazards Mitigation Plan affects all areas of the county: incorporated urban areas, and the rural, unincorporated areas of the county. Figure 1-1 shows cities, urban unincorporated areas, and major roads and rivers in Greene County. This plan provides jurisdictions within the county, the resources, background information and recommendations to lessening the impact of natural hazards and gives recommendation for local mitigation efforts and partnerships.

The plan is reviewed every five years to update hazard events, to assess the effectiveness of the implemented planning and mitigation strategies, and accordingly modify the proposed mitigation actions for the next five year period.



• Figure 1-2: Greene County

Who does this plan cover?

The Greene County Natural hazard Mitigation Plan was created for the benefit of all jurisdiction in the county. Upon adoption, the plan will apply to the following jurisdictions:

Greene County Jurisdictions	
City of Beavercreek	**Beavercreek Township**
City of Bellbrook	**Caesarscreek Township**
City of Fairborn	**Cedarville Township**
City of Xenia	**Jefferson Township**
Village of Bowersville	**Miami Township**
Village of Cedarville	**New Jasper Township**
Village of Clifton	**Ross Township**

Village of Jamestown	**Silvercreek Township**
Village of Spring Valley	**Spring Valley Township**
Village of Yellow Springs	**Sugarcreek Township**
Bath Township	**Xenia Township**

- Figure 1-1: Greene County Jurisdictions

The 2014 Mitigation Plan Update

To seek support for updating the existing mitigation plan, the Greene County Emergency Management Agency focused on the resources needed to update the existing hazard mitigation plan. Essential steps included identifying, organizing and re-assembling members of the community as well as technical expertise required during the plan update process.

As a result, the Greene County Emergency Management sought support and information from various jurisdictions, business, industry, non-profit organizations, other interested organizations and individuals. Obtaining the support of community and organizational leaders was the best foundation for the plan update effort. Pending Federal approval, the County and its participating jurisdictions intend to formally adopt this plan by passing a Resolution or Ordinance.

The Mitigation Planning Team was formed by notifying and assembling individuals and organizations that previously served on the team when the plan was first drafted for 2006 and invited them to participate in updating the plan. The full list of individual representing these organizations and their contact information can be found in Appendix A.

- Greene County Office of Emergency Management
- Greene County Building Regulations Department
- Greene County Department of Public Works
- Greene County Department of Environmental Services
- SBC Ameritech, Damage Prevention Council
- Greene County Health Department
- Dayton Area Chapter of the Red Cross

Engaging the Public

Public participation and input to the planning process was first announced through a press release to new media outlets. The press release was issued on March 24, 2014. The article directed the attention of the public to the Greene County Emergency Management Agency website to review the 2014 mitigation plan online and provide feedback by phone or e-mail. No comments were received by the public. A copy of the news release is shown in Appendix A of this plan.

Throughout the plan development phase, the public was invited to attend and participate in Mitigation Planning Team meetings. Meeting locations, dates and times were made to the public and announcements were posted at meeting locations. A copy of the announcement is shown in Appendix A of this plan.

After the planning process was finished, the public had the opportunity to review and comment on the revised plan. These methods followed the same as those listed above when the public reviewed the previous plan. A screen shot of the website featuring the revised plan, available for public review, is exhibited in Appendix A of this plan.

Though the public had the opportunity to comment on the plan before it was sent for State and Federal review, no comments were received.

Conducting the Hazard Analysis

Hazard analysis is the foundation upon which all emergency planning efforts in the community are built and provides an understanding of the potential threats facing the community. By pinpointing the exact location, extent and magnitude of past disasters, and by examining new or emerging risks, it is possible to determine the probability of such events occurring and the vulnerability of people and property. By reviewing this information along with available land use, geographic, economic, and demographic information, the mitigation planning team developed priorities and goals for mitigation for the segments of the community, which might be adversely impacted by various types of hazards.

Hazard analysis can be broken into four basic steps:

- Develop a community profile
- Identify the hazards
- Profile each hazard
- Conduct a vulnerability analysis and estimate losses

Develop community profile

To develop a community profile, the key areas in the community were identified such as historical resources, industries, critical facilities, present and future land uses and development. Information regarding geography, climate, and demographics were also included in this profile.

Identifying and profiling hazards

The next step in hazard analysis involved the identification of those natural hazards to which the community is susceptible. Greene County is susceptible to a number of natural hazards. The following natural hazards were determined to be the most pervasive and concerning hazards to mitigate for:

- Tornados and Wind
- Severe winter storms
- Flood
- Severe summer heat and drought
- Hail
- Earthquakes

In the identification process the research team found no record of the following natural hazards, these hazards were not considered to adversely affect the community on a regular or recurring basis.

- Wildfires
- Landslides
- Land subsidence

The following sources assisted in the hazard identification process.

Historical records

The pre-mitigation planning team researched local historical data (such as newspaper accounts) to determine the types of hazards the community either has experienced or to which the county is susceptible. In addition, long-term community residents were interviewed as a good source of information regarding historical natural hazard events. Another resource utilized was the local historical societies and local historical special collections and archives. Drawing from local information sources is important because it provides information on those events that may not have been widespread or severe enough to receive national attention, but nonetheless had a significant impact on the community.

Existing plans and reports

The pre-mitigation planning team reviewed existing reports and plans such as state mitigation plans, hazard identification reports, studies, local emergency response plans, and local comprehensive plans, etc. However, these plans were lacking in information regarding mitigation for natural hazards.

The planning team in 2012 reviewed and incorporated into the mitigation plan all local and county building codes, fire codes, zoning regulations, floodplain ordinances and/or regulations, Comprehensive Land Use Plans, and the Flood Insurance Study Jan 6, 2005. The Greene County Emergency Operations Plan and the Greene County Hazardous Materials Contingency Plan (which includes Hazard Analysis for all EHS Facilities), as well as local emergency operations plans, were reviewed also. This process included identifying how many of the participating jurisdictions had an Emergency Mitigation Plan, Emergency Response Plan, Storm Water Management Plan, Floodplain Management Plan, Storm Drainage Improvement Plan, Soil Management Plan, Erosion Control Plan, and Building Codes. Once that information was compiled a determination could be made on which areas to focus mitigation efforts. (Refer to the following table)

Jurisdictional Plans and Programs

Jurisdiction	Emergency Mitigation Plan	Emergency Response Plan	Storm Water Management Plan	Development within Floodplain	Storm Drain Improvement Plan	Soil Management	Erosion Control	Building Codes
Bath Twp		X		X				
Beavercreek		X	X	X	X			
Beavercreek Twp		X	(wetlands)	X			X	
Bellbrook		X	X	X	X			
Bowersville		X						
Caesarscreek Twp		X		X				
Cedarville		X						
Cedarville Township		X		X				
Clifton		X						
Fairborn		X	X					
Greene Co.		X		X				X
Jamestown		X						
Jefferson Township		X		X				
Miami Township		X		X				
New Jasper Twp		X	X	X				
Ross Twp		X		X				
Silvercreek Township		X		X				
Spring Valley			X	X				
Spring Valley Twp		X		X				
Sugarcreek Twp		X		X				
Wilberforce								
Xenia TWP		X		X				
Yellow Springs								

Internet websites

Information on hazards was also obtained through Internet websites.

Hazard Research

After the completion of the initial hazard identification of Greene County, the pre-mitigation planning team focused on identifying the most prevalent hazards.

- Tornados and Wind
- Severe winter storms
- Flood
- Sever summer heat and drought
- Hail
- Earthquakes

A hazard event profile was developed for each potential hazard that was identified as a threat to Greene County.

Flood hazard information was obtained from the boundaries of the Flood Insurance Rate Map (FIRM) as translated by the Ohio Department of Natural Resources (ODNR).

Earthquake hazard information was collected from the http://usgs.gov website and OhioSeis maps and data.

All weather hazard information was obtained from the http://www.ncdc.gov and www.fema.gov website.

Population and business figures were collected from the U.S. Census and Ohio Bureau of Employment Services.

During this step the Pre-mitigation Planning Team determined how much property and what segment of the population are located in probable hazard areas. To complete this step the committee needed to:

- Determine the total number of buildings in the community. The information was obtained from Census 2010 and tax assessment maps, Geographic Information Systems (GIS), Aerial Photographs and local planning documents.

- Determine the total estimated value of buildings in the community. When available, this information was obtained from tax assessments of individual buildings.

- Determine the total number of people in the community. This information was obtained from census data and local data. Noted were any large seasonal or daily population changes.

- Determine the total number of buildings inside the hazard areas. The information was obtained from tax assessment maps, GIS, and/or aerial photographs.

- Determine the total estimated value of buildings inside the hazard areas. This information was obtained from tax assessment values and from estimating whole areas from Census figures.

- Determine the total number of people inside the hazard areas. This information was obtained from census data and local data. Noted were any large seasonal or daily population changes.

- Determine the location of expected growth in the community by consulting local officials.

- Complete vulnerability analysis and estimate losses

To complete the hazard analysis, the vulnerability of the community to various hazards needed to be determined. A hazard is only a problem when it can cause harm to people or damage property. In determining the communities' vulnerability the Pre-mitigation Planning Committee:

- Identified and mapped community hazard areas

- Developed and applied hazard-specific disaster scenarios to determine critical issues that needed to be addressed pertaining to specific community sectors, safety, loss of critical functions or facilities, public health impacts, economic impacts, and short and long-term recovery

- Determined who had the emergency response authority for each identified vulnerability

- Determined planning and resource allocation needs and considerations for implementing priority activities identified in the previous steps.

The final step in the hazard analysis process is estimating losses that would occur during a hazard event and creating a composite map of the loss areas. The expected percentage of damage to structures will vary greatly, based upon the age of the building, construction materials used and severity of the hazard. In this step our committee needed to:

- Determine the extent of damage from floods.
- Determine the extent of damages from earthquakes.
- Determine the extent of damages from tornadoes.
  (The percent of losses are based upon worst-case scenarios developed from regional past occurrences.)
- Determine the extent of damages from all other hazards identified as a threat to the community.

Information in the Mitigation Plan is based on research from a variety of federal, state, and

local resources. The Center for Urban and Public Affairs (CUPA) at Wright State University conducted data research and analysis, facilitated Pre-mitigation Planning Team meetings, held public informational sessions, and developed the final mitigation plan.

CUPA collected data and compiled research on all of the hazards identified in the FEMA – Understanding Your Risks Guide: flood, landslide, severe winter storm, windstorm, wildfire, earthquake, and volcanic eruption. Research materials came from Federal, State of Ohio, and local agencies including:

- Federal Emergency Management Agency
- United States Department of the Interior, United States Geological Survey
- National Climatic Data Center
- National Oceanic and Atmospheric Administration
- National Parks Service
- Ohio Department of Natural Resources
- Ohio Department of Public Safety, Emergency Management Agency

In addition, CUPA staff and students conducted research by referencing historical local newspapers and documents and locating County information in recent and historical scientific documents.

Estimated Hazard Costs

Wherever possible in this analysis and plan, costs are expressed in terms of "real dollars," and have been adjusted for inflation so that all dollar figures are expressed using the value of money in the current year (2011). Dollar figures have been calculated to 2011 values using the Consumer Price Index for all urban consumers (CPI-U) as provided on the Bureau of Labor Statistics website, http://www.bls.gov/ and/or the Federal Reserve Bank website, http://minneapolisfed.org/research/data/us/calc/index.cfm.

Some figures in this report are expressed in “nominal dollars” (without adjusting for inflation), because estimates for disaster declarations were expressed for several disasters over a multiple years without a specific year breakdown, and therefore could not be adjusted. These figures are represented with an asterisk (*) behind the dollar figure.

Selecting and Ranking the Problem Statements

The core group brainstormed and outlined every problem statement. Problem statements with insufficient data to support them were then removed. Problems beyond the influence of the core group, or poorly defined problems, were also removed. Once this phase was complete, the planning team ranked the problems considering the impact each problem has on the community.

Setting Goals

Once the group had a clear understanding of the community hazards, the community's hazards cause, the next step was to identify the goals, which would most effectively minimize or eliminate the problems.

CUPA examined existing mitigation plans from around the country, current planning and regulation documentation from the County's many jurisdictions, current FEMA planning standards, and the National Flood Insurance Program's Community Rating System. Statewide reference materials consisted of community and county mitigation plans.

CUPA conducted interviews with and collected data from local jurisdictions. Research identified common concerns related to natural hazards and Identified existing and potential activities to reduce risk from natural hazards. A complete listing of all stakeholders is located in Appendix C.

Stakeholders interviewed for the plan included representatives from:

- City Government
- Township Government
- Regional Planning Organizations
- Fire Departments
- Utility Providers

In the final step, the planning team developed the goals - general guidelines that explain what you want to achieve - and the activities - strategies or implementation steps to attain the identified goals.

Integration into Other Planning Mechanisms

The county's process to integrate the data, information, and hazard mitigation goals and actions in other planning mechanisms is accomplished through select members on the Mitigation Planning Committee. These members from Mitigation Planning Committee include, but are not limited to:

- County Commissioners
- County Emergency Management Agency
- Floodplain Administrators (County and jurisdictions)
- County Sheriff's Office
- County Geographic Information System Staff

These Committee Members take information to their respective organizations that are charged with the development, maintenance, and on occasions, enforcement of rules, regulations, codes, ordinances, policies, plans, procedures and other administrative instruments. Information from mitigation planning is presented to the leadership of these organizations, who then authorize the information to be added, to revise or update current administrative instruments. This allows for oversight, commitment of time, energy, and resources to change actions into projects.

Although the jurisdictions do not have as many representatives to serve on the Committee, their representatives follow the same processes as those at County level.

How this plan is constructed

Chapter 1: Introduction

The Introduction describes the background and process of developing the mitigation plan for Greene County

Chapter 2: Community Profile

This section illustrates the history, geography, demographics and socio-economics of Greene County.

Chapters 3 through 10: Natural Hazard Risk Assessment

These chapters provide the hazard identification, vulnerability and risk associated with natural hazards in Greene County.

Chapter 10: Multi-Hazard Goals and Action Items

This section provides information on the process used to develop the goals and action items to address the problems faced from natural hazards.

Chapter 11: Plan Maintenance

This section provides information on implementing, monitoring, and updating the plan.

Appendices

Appendix A: Public, Private, and Governmental Participation in the Process

This section provides the documentation of all correspondence during the planning process

Appendix B: Critical Facilities

This section provides detailed information regarding the critical facilities inventory as required by the State of Ohio Emergency Management Agency and FEMA Region V. These documents were not included in the general text of the plan for security reasons, but can be provided on a need-to-know basis.

Appendix C: Acronyms and Definitions

This section provides a list of acronyms for the organizations and plans referenced in this Mitigation Plan. It also provides the definitions of terms relating to hazards and mitigation activities frequently used in this plan.

Appendix D: Structures in the Special Flood Hazard Area

This section provides a list of acronyms for the organizations and plans referenced in this Mitigation Plan. It also provides the definitions of terms relating to hazards and mitigation activities frequently used in this plan.

Appendix E: Resolutions Supporting the Plan

This section provides the resolutions passed by the individual jurisdictions supporting the plan.

Chapter 2 Hazard Analysis Introduction

Floods, earthquakes, tornadoes and high winds, thunderstorms, snowstorms, droughts, and temperature extremes — Greene County has them all. These events can damage and even incapacitate a community for an extended period of time. Knowing the likelihood of a disaster is the best protection from a disaster. Learning to live with the natural forces, which surround us, minimizes the outcome of natural disasters.

Since 1964 federally declared disasters in Ohio (excluding insurance) cost more than $473 million dollars in damages. In 1964, 1968, and 1989 Presidential disaster declarations covered over $10.9 million dollars in flood damages statewide, which included awards to Greene County. The blizzard of 1978 affected all 88 counties in Ohio and $9.9 million was awarded to the State to cover damages. A tornado ravaged portions of the city of Xenia in the tornado outbreak of 1974. Presidential declarations to fourteen counties as a result of super outbreaks amounted to $45.5 million dollars in damages. On September 20, 2000 high winds and tornadoes caused over $4.8 million dollars in damages in Xenia and Greene County and again a Presidential disaster declaration was issued.

COUNTY:	Greene		
DISASTER NUMBER	DISASTER TYPE	DECLARED	PUBLIC ASSISTANCE
DR-167	Heavy Rains and Flooding	3/24/1964	$ 12,159.19
DR-243	Heavy Rains and Flooding	6/5/1968	$ 20,000.00
DR-831	Severe Storms and Flooding	6/10/1989	$ 45,459.00
DR-1343	Severe Storms Tornado	9/20/2000	$ 221,904.67
DR-1805	Severe Wind Storm Associated with Tropical Depression IKE	10/24/2008	$ 1,729,195.62
EM-3198	Snow Storm	11/1/2005	$ 310,210.45
EM-3286	Record / Near Record Snow Storm	4/24/2008	$ 379,346.61
		TOTAL	$ 2,718,275.54

Figure: 2-1 Public Assistance Since 2000

Since 1950, the county has encountered over 200 storm or earthquake related events with the most prevalent being thunderstorms. Eighty-eight thunderstorms have produced damaging lightning, high winds, flooding, and/or hail and spawned a total of 14 tornadoes. Eighty-eight of these events caused property damage ranging from eleven hundred dollars to $932 million. In addition, these same events caused 12 injuries and 10 deaths.

Major weather disasters in the U.S. have caused billions of dollars in damages over the past twenty-five years. Drought caused $62 billion in damages in 1988; Hurricane Andrew, $32.8 billion; the floods of 1993, $15.3 billion; and the list goes on.

The purpose of this hazard analysis is to lay the foundation for setting priorities and identifying mitigation projects in the next phase, The Mitigation Plan. The statistics in the following chapters illustrate the existing conditions (population, housing, and economics) and show the types of natural disasters, which have occurred in Greene County over the last fifty years and in some cases, further back in history. This historical information illustrates when events are likely to occur and the possible damages, injuries, and fatalities, which may result.

Chapter 3 Inventory of Existing Conditions

Greene County is located in the southwestern part of the State of Ohio, just east of Montgomery County and Dayton. Established May 1, 1803, these 266,350 acres were named for Nathaniel Greene, a hero of the American Revolution.

As shown in Figure 1-1, east and west transportation through Greene County is provided primarily by U.S. Route 35, which runs east/west through the middle of the county, Beavercreek, Xenia and Jamestown. Interstate 675 skirts around the western edge of the county, running north to south and connecting Interstates 75 and 70 through the population center of Greene County. In addition, U.S. Routes 42 and 68, and State Routes 72 and 235 offer primary north and south access across the county. Part of Interstate 71 passes through the southeast corner of the county. Interstate 71 connects Louisville, Kentucky to Cleveland, Ohio. Greene County also has active freight railroad lines in the northwest portion of the county. But, many of the existing railroad lines have been abandoned and converted to bike paths, for which the county has become renowned. The County, with a population of 161,573, is home to 4 cities, 6 villages, 9 and 12 townships.

Greene County was home to Colonel Charles Young (1864-1922), the third African American to graduate from West Point and the highest-ranking African American officer of the First World War. Other historical attractions include the Clifton Mill, Antioch University and the Greene County prairie where the Wright brothers began their early experiments in flight, now Wright Patterson Air Force Museum. In addition, Greene County's natural attractions include the Little Miami National Scenic River, Clifton Gorge and John Bryan State Park in Miami Township, and the Spring Valley Wildlife Area. Greene County is also home to unique cultural attractions including the National African-American Museum and Cultural Center and the Blue Jacket Outdoor Drama.

The county is also unique in that it has two public universities and three private, non-for-profit universities, thus influencing the educational attainment level of its residents. The county also has twelve public school districts that deliver education in thirty-seven public schools and in eight private schools.

Geography & the Environment

Greene County, located along the Little Miami River in southwestern Ohio, is primarily agricultural, especially the eastern half of the county. Greene County has a land area of 421 square miles. The general landscape of the county is a plain with an average elevation above sea level of about one thousand feet, with elevation ranges from 730 feet to 1135 feet. Land use within the county is arranged into six major categories and, as might be expected, the largest use of land (70%) is for cropland. Urban uses comprise 15% of the county. Like other suburban counties in Ohio, Greene County's population is distributed across multiple communities (both cities and townships), as opposed to having a large population centralized in one city.

Greene County is in four major watersheds. The major watershed is the Little Miami Watershed, and the other three watersheds are the Great Miami, the Lower Great Miami, and the Paint. Two major features characterize its topography, the valleys of the Little Miami River and Beaver Creek. The major bodies of water within the county are Caesar's Creek, which is located within the southeastern townships of the county, and the Little Miami River.

Greene County is bordered on the north by Clark County and in the south by Warren and Clinton Counties. Greene is also bordered on the east by Fayette and Madison Counties, and on the west by Montgomery County.

Major Rivers

The major river that runs through the county is the Little Miami River, which is 105.5 miles in length and covers about 1,757 square miles. The surface water within Greene County can be described as very hard, calcium-magnesium-bicarbonate waters. The Little Miami River Basin lies within the Till Plains section of the Central Lowland physiographic province.

Climate

Greene County's climate can be considered a temperate humid continental climate. This type of climate is characterized by moderate temperatures and precipitation and is typical of areas that are at a great distance from the oceans or other major bodies of water. And yet, the change to new seasons happens gradually. The majority of the precipitation and hazardous weather comes from tropical air masses in the Gulf of Mexico and the western Atlantic Ocean. While Greene County is adjacent to Montgomery County, Greene has experienced more weather-related hazards than its neighbor and this fact is most visible by studying the trends affecting the county seat, Xenia. Major thunderstorms have resulted in the two most common hazards in the County, tornados and flooding. The largest tornado occurred in 1974 and damaged half of the City of Xenia.

Temperate continental characterizes the climate of the Great Miami Watershed. Extreme temperatures and precipitation can depict this type of climate, too. However, the adjustment to different seasons happens gradually. Due to its distance from the ocean, Greene County is hot in the summer and cold in the winter.

According to the National Weather Service, the average summer temperatures range from 70°F to 90°F. The average winter temperatures range from 25°F to 50°F. The average annual rainfall is 39 inches and the average annual snowfall is 20 inches.

Month	High Mean°F	Year	Low Mean°F	Year	1-Day Max°F	Date	1-Day Min°F	Date
JAN	39.1	2006	11.6	1977	71	01/24/1943	-25	01/18/1994
FEB	39.2	1998	16.9	1978	73	02/11/1999	-16	02/02/1951
MAR	51.3	1946	26.7	1960	82	03/22/1938	-7	03/02/1980
APR	57.3	1941	45.0	1950	89	04/30/1962	15	04/08/1972
MAY	69.4	1965	55.8	1997	93	05/31/1937	26	05/01/1963
JUN	75.5	1943	66.5	1958	102	06/25/1988	40	06/11/1972
JUL	81.4	1936	69.3	1947	106	07/14/1936	44	07/06/1972
AUG	79.3	1936	68.2	1946	102	08/19/1936	40	08/03/1965
SEP	71.9	1939	60.5	1974	101	09/06/1954	32	09/23/1974
OCT	62.9	1971	47.1	1988	89	10/04/1954	21	10/26/1962
NOV	48.7	2001	35.2	1976	79	11/01/1950	-2	11/30/1958
DEC	39.6	1982	19.0	1989	72	12/02/1982	-20	12/22/1989

Figure 3-1: Temperature Means and Extremes – Period of Record: 1935-2010[5]

Month	High (in)	Year	Low (in)	Year	1-Day Max (in)	Date
JAN	12.41	1937	0.30	1981	4.16	01/21/1959
FEB	5.77	1990	0.14	1947	2.58	02/20/1951
MAR	7.65	1964	0.65	1941	2.95	03/24/1913
APR	9.20	1996	0.56	1962	3.10	04/02/1977
MAY	9.06	1995	0.90	1934	3.17	05/23/1989
JUN	10.89	1958	0.32	1962	3.76	06/05/1981
JUL	8.56	1990	0.33	1916	3.16	07/09/1955
AUG	8.03	1974	0.03	1996	3.38	08/05/1995
SEP	10.84	2011	0.27	1963	3.81	09/16/2005
OCT	7.08	1919	0.10	1944	3.54	10/05/1995
NOV	8.07	1985	0.34	1917	2.94	11/18/1938
DEC	10.04	1990	0.36	1955	2.85	12/30/1990

Figure 3-2: Precipitation Extremes – Period of Record: 1911-2012[2]

[5] NCDC – Historical Climate Data referenced from Weather Station 332075 Dayton WSO AP, OH

Month	High (in)	Year	1-Day Max (in)	Date
JAN	40.2	1978	12.2	01/26/1978
FEB	23.1	2010	7.7	02/05/2010
MAR	15.8	2008	11.2	03/22/1968
APR	4.9	1974	4.7	04/08/1974
MAY	-	-	-	-
JUN	-	-	-	-
JUL	-	-	-	-
AUG	-	-	-	-
SEP	-	-	-	-
OCT	5.8	1989	4.8	10/19/1989
NOV	12.6	1950	8.0	11/25/1950
DEC	15.6	1960	7.0	12/26/2012
Season (Jul-Jun)	62.7	1977-78	12.2	01/26/1978

Figure 3-3: Snowfall Extremes – Period of Record: 1911-2012[3]

Minerals and Soils

The major geologic features within the county are Pleistocene glacial deposits that overlay lower Paleozoic limestone, dolomite, and shale bedrock. The glacial deposits that overlay these minerals are predominantly till deposits that were left by the last glaciers about 20,000 years ago. The rock formations that exist within the county consist of two great series; the Upper and Lower Silurian age. These two series are evenly distributed throughout the county. Within these two ages (Upper and Lower Silurian) there are three major elements; Niagara Group, Clinton Limestone, and the Cincinnati Series – Lebanon division. The thickness of these rocks combined is four hundred and twenty-five feet. The major mineral deposit within the county is limestone.

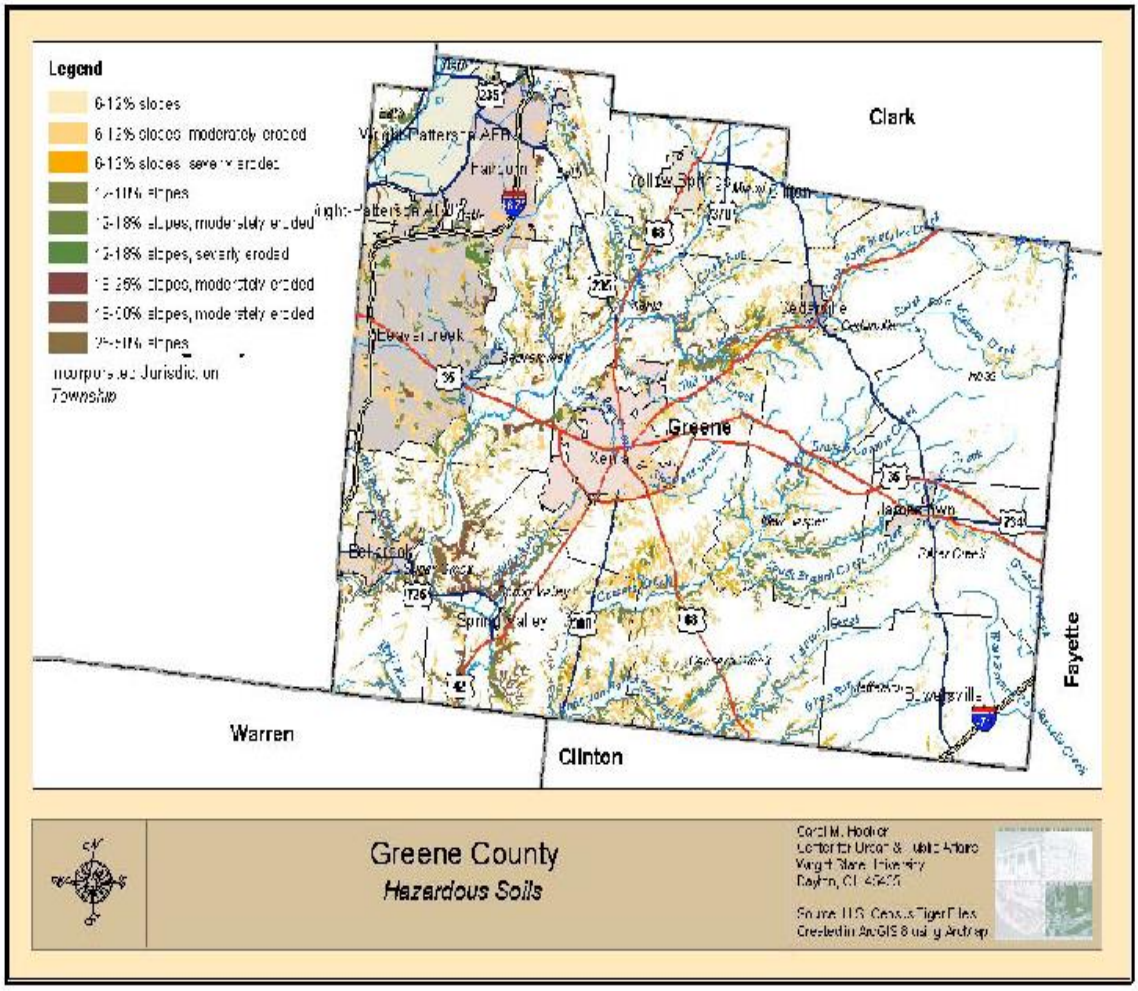
The soils within the county are very fertile and productive. The drainage of these soils is moderate, which helps to keep the soil fertile. The soil is derived from loess or glacial deposits. Most of the soils within the county have greater than 3% organic matter within the first ten inches below the surface.[2] These soils indicate that the county may be prone to flooding.

Conducting a thorough and precise emergency mitigation plan requires the identification of hazardous soils within the county. These soils are major indicators of the feasibility of a hazard. The few hazards that could affect the county would be flooding and erosion. All of these soils are

susceptible to erosion or degradation. These soils should not be used with the placement of buildings and structures. The emergency mitigation plan needs to identify a hazardous soil. The increase of the soils exposure to hazards can cause a greater emergency. The following soils were identified by the Regional Planning Commission as possible hazardous areas in Greene County. Further information and description can be found in the Soil Survey[3] book for Greene County.

Soils with Steep Slopes

Steep slopes are those areas where the change in elevation exceeds 10% or for every 100 feet of horizontal movement, there is a change in the elevation, a rise or drop of 10 feet. In Greene County, steep slopes occupy only a small portion of the total area in the county (Refer to Figure 3-2).



• Figure 3-4: Greene County Potentially Hazardous Soils

CcD2- Casco-Eldean loams, 12-18 percent slopes, moderately eroded

The moderately steep soils of this complex are on long, narrow breaks between the bottomlands and the higher lying, less sloping soils on stream terraces. These soils are also on gravelly knolls and ridges of the uplands. This complex is about 50 percent Casco soils, 35 percent Eldean soils, and 15 percent included soils.

These soils are moderately eroded. Much of the original surface layer has been removed through erosion. In some spots the present surface layer is 20 to 30 percent gravel.

The soils in this complex are used mainly for pasture or woodland. Runoff is rapid. The hazard of erosion is very severe. The hazard of drought is severe. The surface layer is low in organic content. Establishing plants is very difficult. Slope and droughtiness are the dominant limitations for most farm and non-farm uses.

CdE2- Casco-Rodman loams, 18-50 percent slopes, moderately eroded

The steep to very steep soils in this complex are in bands on side slopes of kames and terrace escarpments, mainly in the western and northwestern parts of the county. This complex is about 50 percent Casco soils, 35 percent Rodman soils, and 15 percent included soils. The Casco soil in this complex has the profile described as representative of the Casco series. Rodman soils are mostly on the lower two-thirds of the slopes.

These soils have a severe hazard of drought and a very severe hazard of erosion if used for farming. Slope is the main limitation for non-farm uses.

EdD2- Edenton silt loam, 12-18 percent slopes, moderately eroded

This soil is in strips adjacent to the larger drainage ways in sloping areas. Most areas are 5 to 30 acres in size.

Because runoff is rapid, the hazard of erosion is very severe if this soil is used for cultivated crops. Slope, moderately slow permeability, and depth to bedrock are limitations for non-farm uses.

FaF- Fairmount silty clay loam, moderately deep variant, 25-50 percent slopes

This soil is in narrow bands along the valley walls of the Little Miami River and some of its larger tributaries in the southern part of the county. Slopes are generally irregular. Limestone fragments as much as 12 inches in diameter are commonly on the surface of this soil. Fragments tend to accumulate at the base of slopes.

This soil included areas that are moderately eroded, a few areas of soils that have slopes of 18 to 25 percent, and a few areas of soils that have a surface layer of silty loam. Also included are spots, which are slightly deeper than this Fairmount soil to the interbedded limestone and shale.

Runoff is rapid, and the hazard of erosion is a severe limitation to the use of this soil for farming. The very steep slopes are a severe limitation for most non-farm uses.

MhD2- Miamian silt loam, 12-18 percent slopes, moderately eroded

This moderately steep soil is on sides of valleys that parallel drainage ways. This soil has lost part of the original surface layer through erosion.

Runoff is rapid. The hazard of erosion is severe unless a thick cover of vegetation is maintained. Slope is a severe limitation for most non-farm uses.

MID3- Miamian clay loam, 12-18 percent slopes, moderately eroded

This moderately steep soil is on narrow breaks at the heads of drainage ways. Erosion has removed much of the original surface layer. The existing surface layer is mostly moderately fine textured material from the subsoil. Short shallow gullies, 1 foot to 2 feet deep, are common.

The surface layer is very low in organic matter content, which has reduced its capacity to absorb and retain water. Runoff is rapid. The hazard of erosion is very severe.

This soil is not suited to cultivated crops. Slope is the main limitation for non-farm uses.

MmD2- Miamian-Casco complex 12-18 percent slopes, moderately eroded

This complex is on long, narrow ridges and knolls in areas of moraines where kames are common. A few spots are severely eroded.

These soils have a plow layer that consists of a mixture of material from the original surface layer and from the subsoil. The surface layer is silt loam or loam. A few areas are gravelly loam. The underlying material is variable, and changes occur within short horizontal distances.

These soils are mostly used for crops and pasture. A few areas are in woodland. The hazard of erosion is severe. Casco soils are droughty during summer. Slope is the main limitation for most non-farm uses.

MmE2- Miamian-Casco complex, 18-35 percent slopes, moderately eroded

This complex is mainly on kames or moraines, and most areas are circular or irregular in shape. In most area this complex is about 50 percent Miamian soils, 35 percent Casco soils, and 15 percent included soils. The underlying material of these soils is quite variable in composition, alternating between glacial till and sand and gravel within short horizontal distances.

The main limitation to the use of these soils for farming is a very severe hazard of erosion if cultivated crops are grown. In addition, the Casco soils and the included Rodman soils are droughty during summer. Slope is a severe limitation for most non-farm uses of these soils.

MpE- Miamian and Hennepin soils, 18-25 percent slopes

Individual areas of this undifferentiated group contain Miamian soils, Hennepin soils, or both soils in various proportions. Miamian soils have a profile similar to the one described as representative of the series, but they are shallower to calcareous material.

These soils are too steep to be used for crops. They are most commonly used for pasture or woodland. The steep slopes are a severe limitation for most non-farm uses.

MpF- Miamian and Hennepin soils, 25-50 percent slopes

This complex is on steep side slopes on uplands near rivers and large tributaries. Slopes are smooth and uniform and most are slightly convex in the upper part and slightly concave at the base. A few areas of soils in this group have as much as 70 percent slopes.

These soils are mainly used for pasture or woodland. They are too steep to be used for crops. Runoff is rapid. The hazard of erosion is very severe. The very steep slopes are a severe limitation for most non-farm uses.

MuF- Milton soils, channery variant, 25-50 percent slopes

This undifferentiated group of very steep soils is on side slopes of deeply entrenched valleys along the Little Miami River. Areas normally are less than a quarter of a mile wide, but they may be a mile or more long. Slopes are irregular, and erosion varies within short distances. Most slopes are greater than 35 percent.

The surface of these soils is covered by numerous limestone channers. The lower slopes commonly have an accumulation of talus. Tree roots penetrate this soil to bedrock and into fractures of the bedrock. A few areas of this group have short slopes of more than 50 percent. Also included are a few areas that have limestone ledges exposed on the surface.

The very steep slopes limit the farm and non-farm uses of these soils. These soils are suited for woodland or wildlife.

Rhd- Ritchey silt loam, 12-18 percent slopes

This moderately steep soil is on uplands along Little Miami River. It commonly is in narrow bands parallel to stream valley and escarpments. In some areas, this soil makes up most of the valley side slope.

The hazard of erosion is very severe. Drought is a moderate hazard because the rooting zone is shallow. This soil is generally unsuited to cultivated crops because of steep slope and shallow depth to limestone bedrock. Slope and shallow depth to bedrock are also severe limitations for most non-farm uses.

RhE2- Ritchey silt loam, 18-25 percent slopes, moderately eroded

This steep soil is on hillsides of the bedrock-controlled uplands overlooking the river valleys. Most areas are 5 to 30 acres or more in size. This soil has a profile similar to the one described as representative of the series, but the surface layer is thinner, and limestone flagstones commonly cover 5 to 15 percent of the surface.

Runoff is very rapid. This soil has a very severe hazard of erosion and a severe hazard of drought, which makes it unsuitable for crops. It is suited to woodland or pasture. Slope and shallow depth to bedrock are severe limitations for most non-farm uses.

Soils with Low Bearing Strength

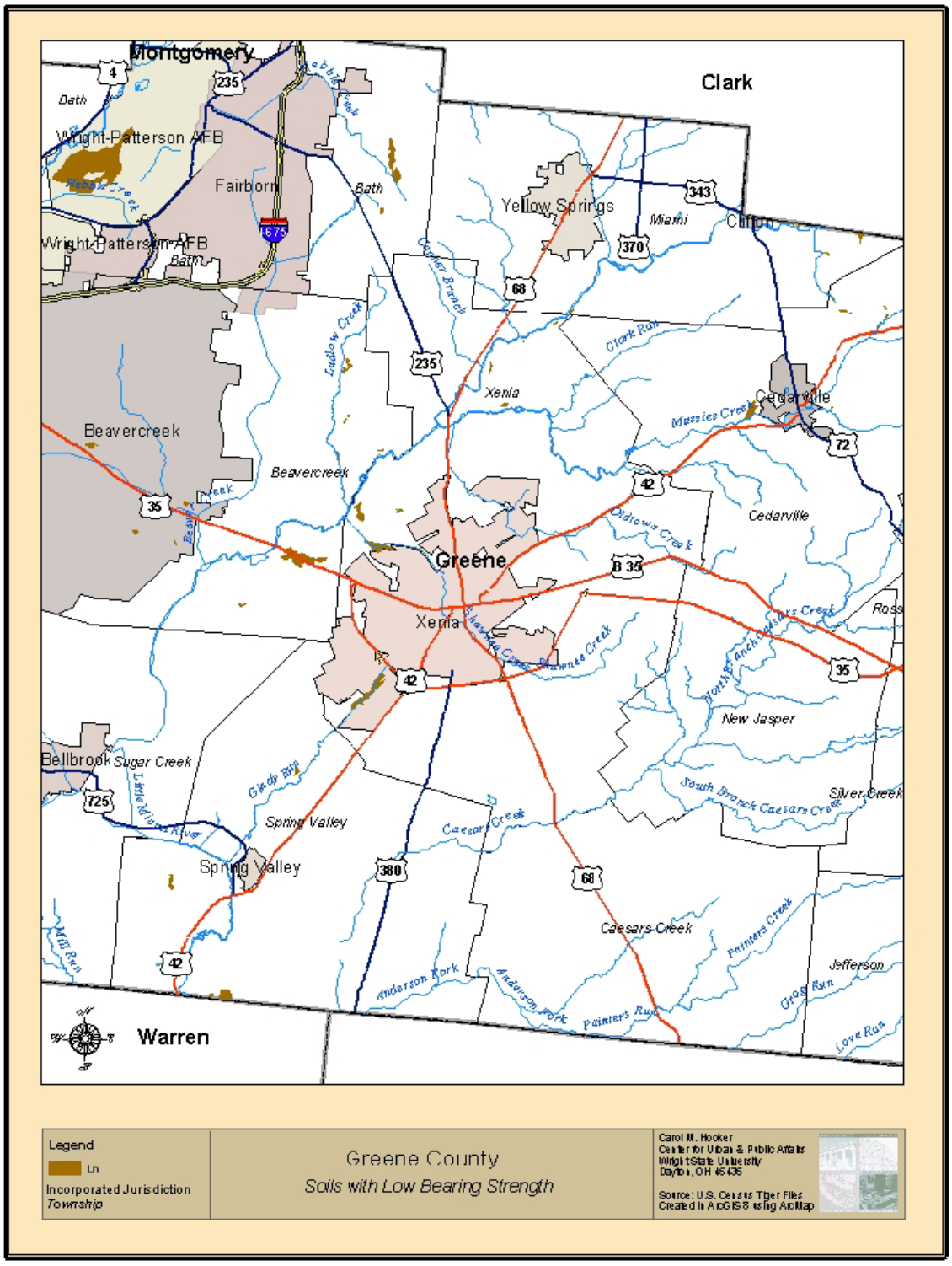
A limited range of particle sizes dominate soils with low wet bearing strength. They are pliable and deform easily under pressure when wet. Low wet bearing strength soils often suffer severe structural damage if cultivated or mechanically disturbed when wet.

Ln-Linwood muck

This soil is mainly in areas of depressions and swales on flood plains and low terraces. These areas commonly receive water from spring and seeps in the nearby uplands or from underground aquifers. A few areas of these soils are in depressions on the uplands.

Included with this soil (Refer to Figure 3-3) are small areas of soils underlain by marl or travertine. Also included are a few areas of soil where the organic layer is thinner than 16 inches or thicker than 50 inches. The included areas where organic layer is thick are mainly in Spring Valley Township near the Warren County line. A few areas near Mad River in Bath Township have lost most of the organic layer as a result of burning.

This soil is in low positions in relation to surrounding soils, and some areas are difficult to drain because they lack outlets. Linwood muck is subject to subsidence if it is drained. It is also subject to soil blowing, especially in open areas when the surface is dry and is not protected by a cover of plants. Wetness is the main limitation to use of this soil for farming. A high water table and low strength are severe limitations for most non-farm uses.



• Figure 3-5: Soils with Low Bearing Strength

Geology

The geology of the watershed where Greene County lies consists of relatively young glacial deposits and overlies a thick sequence of much older sedimentary rocks. The present landscape of today was formed by the erosion of three different sedimentary rock units; Ordovician, Silurian, and Devonian units. All of these rock units were deposited in a shallow inland sea during the Paleozoic Era. During the time of glaciations, the glacier eroded these deposits into what the county looks like today. The glaciations of the area changed the drainage of the watershed. Understanding these geologic characteristics of Greene County is an important step in hazard mitigation to avoid unnecessary risks.

Other Significant Geologic Features

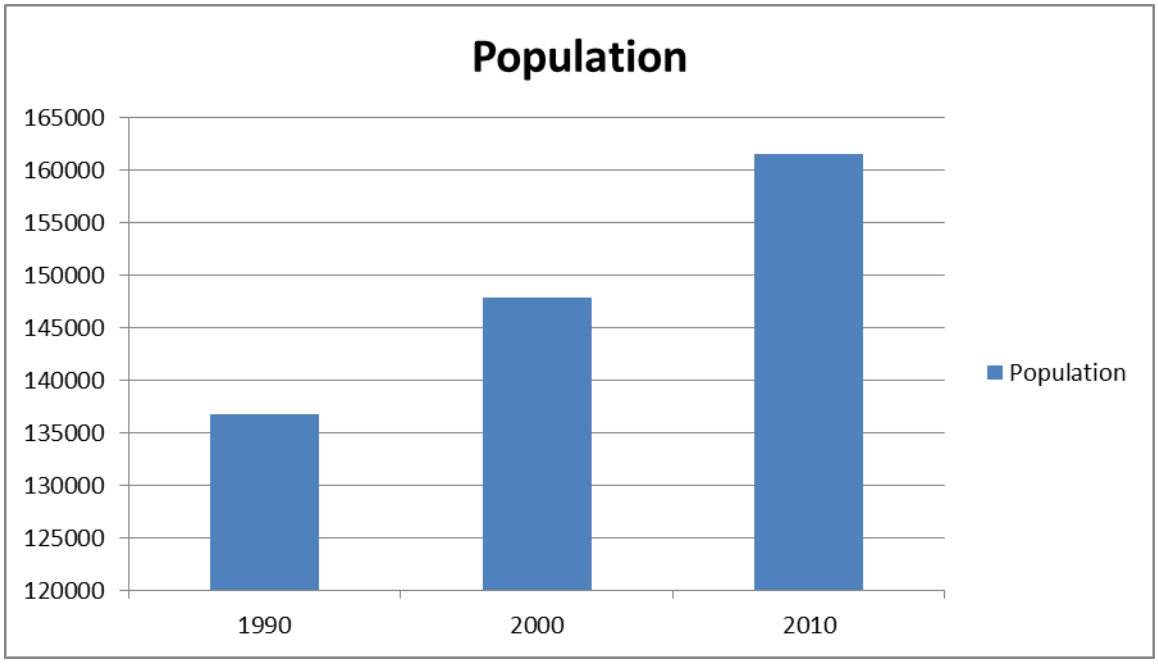
Greene County contains many pristine forest and geologic features. Within the north central portion of the county there are many narrow gorges and cliffs that are exposed. The walls of these features are made mostly of limestone. The one major gorge that is located within this part of the county is Clifton Gorge. Surrounding the gorge are protected forests or preserves. Two of these forests are Glenn Helen Preserve and John Bryan state park, which also show evidence of limestone rock formations.

Population & Households

Population

In 2010, 161,573 people lived in 68,241 households across Greene County. Another 7,781 resided in group quarters. Of all Greene County residents, 139,670 were white, 11,681 were African American, 4,703 were Asian, and 2,452, 428 were American Indian and Alaska Native and 68 reported two or more races and other.

The county has three main cities with populations greater than 20,000 — Beavercreek, Fairborn and Xenia. Two of these cities are located along U.S. Interstate 675 and account for almost half of the population of the county (77,545 residents). Xenia is the county seat and the county's third largest city with a population of 25,719 (see figure 3.6).



• Figure 3-6: Greene County Population

As shown in Figure 3.6, the county's population increased by 8.47% percent from 2000 to 2010 and 15.37% percent from 1990 to 2010.

	Total Population		Pop. Change (%)
Geography	**2000**	**2010**	**2000-2010**
Ohio	11,353,140	11,536,506	1.62%
Greene County	147,886	161,573	8.47%
Bath Township	8,877	6,420	-38.27%
Beavercreek City	37,984	45,193	15.95%
Beavercreek Township	3,063	5,162	40.66%
Bellbrook	7009	6,943	-0.95%
Bowersville	290	312	7.05%
Caesercreek Township	1,225	1,137	-7.73%
Cedarville Township	1,264	1,481	14.65%
Cedarville Village	3,828	4,019	4.75%
Clifton	130	104	-25%
Fairborn	32,052	32,352	0.92%
Jamestown	1,917	1,993	3.8%
Jefferson Township	819	942	13.05%
Miami Township	1215	1,199	0.92%
New Jasper	2538	2,568	1.16%
Ross Township	744	750	0.8%
Silvercreek Township	1771	1,745	-1.48%
Spring Valley Township	1979	2,102	5.85%
Spring Valley Village	510	479	-6.47%
Sugarcreek Township	6,629	8,039	17.53%
Xenia	24,164	25,719	6.04%
Xenia Township	6,117	6,537	6.42%
Yellow Springs	3,761	3,487	-7.85%

Source: 2010 U.S. Census, Population and Housing & 1990 U.S. Census, Population and Housing Survey.

• Figure 3-7: Greene County Cities, Townships, and Villages

At the start of 2010, the largest population age group (33,375) was that of school age children between 5 and 19 years of age, accounting for 20.7% of the county's population. The second largest age group was the cohort of 50 through 54 year olds with a population of 12,054 accounting for 7.5%. Of the county's total population, 21,998 citizens are age 65 years or older which accounts for 13.6% of the population. Of Greene County's population of 161,573, 92.4% graduated from high school which is higher than the overall state average of 88.2% and 35.4% have bachelor's degrees and/or graduate/professional degrees which is also higher than the 24.7% state average.

Age	Number	Percent
Total population	161,573	100.0%
Under 5 years	9,069	5.6%
5 to 9 years	9,777	6.1%
10 to 14 years	9,852	6.1%
15 to 19 years	13,746	8.5%
20 to 24 years	15,723	9.7%
25 to 29 years	10,453	6.5%
30 to 34 years	8,592	5.3%
35 to 39 years	8,746	5.4%
40 to 44 years	9,705	6.0%
45 to 49 years	11,589	7.2%
50 to 54 years	12,054	7.5%
55 to 59 years	10,743	6.6%
60 to 64 years	9,526	5.9%
65 to 69 years	6,596	4.1%
70 to 74 years	5,195	3.2%
75 to 79 years	4,232	2.6%
80 to 84 years	3,111	1.9%
85 years and over	2,864	1.8%

• Figure 3-8: Percent of Population by Age, 2010 -Source: 2010 U.S. Census, Population and Housing

According to the 2010, U.S. Census of Housing and Population, Greene County had 67,884 housing units. Of these units 42,768 were owner occupied units and the median value was $159,600. Conversely, nearly 19,790 units in Greene County were rental units and the median contract rent was $600. The remaining 5,286 were vacant housing units.

Industry and Labor Force

In 2010, approximately 76,713 residents over the age of 16 in Greene County were employed**.** Figure 3-9 shows a comparison of unemployment rates between 2003 and 2013 for Greene County, the State of Ohio, and the United States. Between 2003 and 2013, Greene County peeked in 2010 at 9.6%. Unemployment rates have had a steady decrease dropping to 7.4% in 2013. Unemployment in the county remained below both the national and state averages.

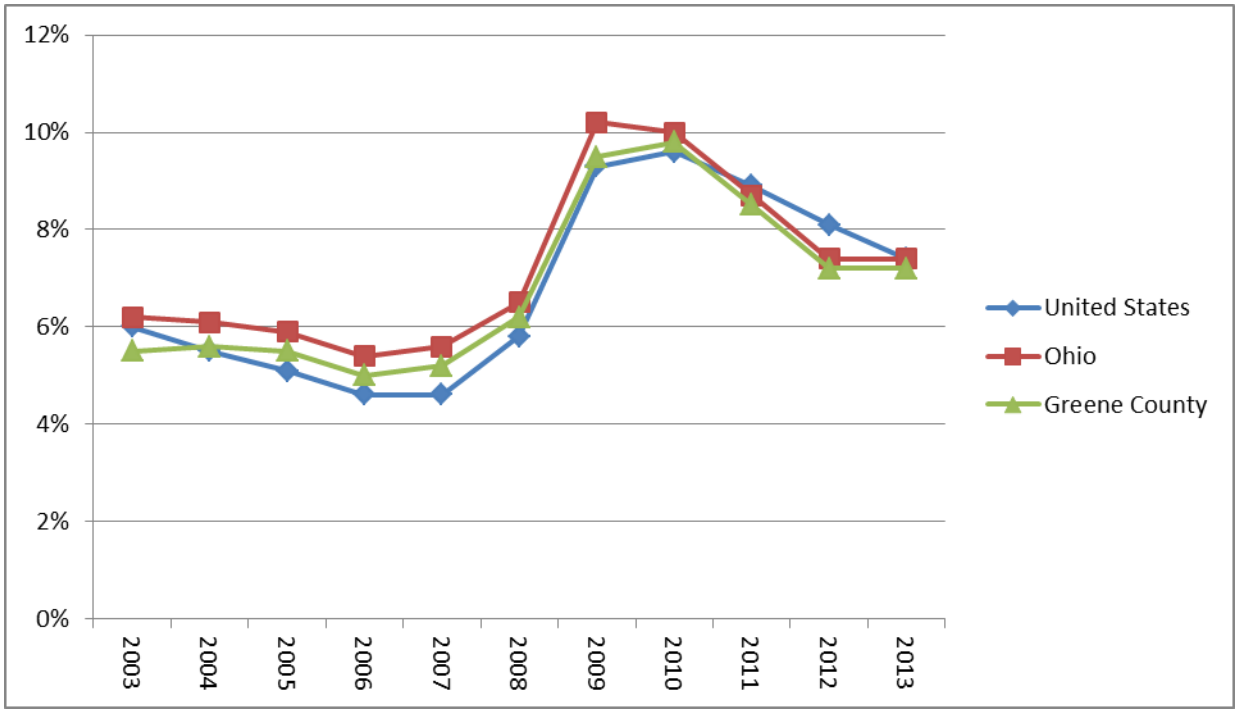


Figure – 3-9

Source: Ohio Labor Market Information, Department of Job and Family Services (www.ohiomi.com)

In Greene County, the private section wholesale and retail trade industry employs more people than any other industry in the county, employing 44,613 followed by the service-providing industry with an average employment rate of 39,858 (see Figure 3-12). The average weekly earnings for individuals in 2011 employed by all industries are listed in Figure 3-13. The Professional and Business Service reports the highest weekly earnings at $1,276. The Information industry yielded the second highest average weekly earnings at $1,176, and the manufacturing sector reported the third highest weekly earnings at $1,041.

Establishments, Employment, and Wages by Sector: 2011

	Number of Establishments	Average Employment	Total Wages	Average Weekly Wage
Private Sector	3,110	44,613	$1,748,755,274	$754
Goods-Producing	396	4,755	$240,351,990	$972
Natural Resources and Mining	20	187	$6,312,643	$648
Construction	252	1,415	$63,361,150	$861
Manufacturing	124	3,152	$170,678,197	$1,041
Service-Providing	2,714	39,858	$1,508,403,284	$728
Trade, Transportation and Utilities	686	11,478	$318,527,431	$534
Information	58	922	$56,339,868	$1,176
Financial Services	296	1,669	$78,812,990	$908
Professional and Business Services	705	10,092	$669,611,105	$1,276
Education and Health Services	370	6,895	$249,611,122	$696
Leisure and Hospitality	343	7,488	$106,410,182	$273
Other Services	241	1,291	$28,386,779	$423

Figure 3-10: Source Ohio County Profiles Prepared by Office of Policy, Research and Strategic Planning

Figure 3-11 presents a list of major employers in the county. The majority of the employers in Greene County are scattered across the western half of the county in the major cities:

Company – Private	Employees
Kettering Health Network	2476
Kroger	774
Unison Industries	700
CACI	650
Teleperformance USA	650
MacAulay Brown	600
SAIC	445
Ball Aerospace	400
Northrop Grumman	400
Wright Patt Credit Union	400

Company – Public	Employees
Wright Patterson Air Force Base	27000
Wright State University	2385
Beavercreek City Schools	1,387
Greene County	996
Fairborn City Schools	564
Xenia Community Schools	555
Central State University	533
Bellbrook-Sugarcreek Schools	265
City of Fairborn	234
City of Xenia	180

• Figure 3-11: List of Major Employers

According to the U.S. Census, approximately 58.4% of the county's workforce was employed in Greene County and spent an average of 20 minutes traveling to work. Of these residents, 84.4% traveled the area's highways and roadways to work alone. Over half of Greene County's residents (51.8%) traveled between the peak hours of 6:30-8:30 a.m.

Critical Facilities

Critical facilities are those facilities that can impact the delivery of vital services, can cause greater damages to other sectors of your community, or can put special populations at risk and should include, but are not limited to the following:

- Fire stations
- Police stations
- Sewage treatment plants (included in this study under Government Facilities)
- Water treatment plants and pumping stations (included in this study under Government Facilities)
- Schools
- Day care centers
- Hospitals
- Retirement homes and senior care facilities
- Critical utility sites such as telephone switching stations or electrical transformers
- Hazardous material storage areas.

In Greene County, we have also included facilities which house a large number of individuals attending special functions because these populations can drastically impact rescue attempts if packed to capacity. A complete list of critical facilities and their locations can be found in Appendix B.

Greene County Critical Facilities	
Assisted Living	18
Child Care Services	55
Cinemas	4
Government	138
Hospitals	2
Police Stations	12
Recreation/Entertainment Ctr	3
Schools	50
Senior Adult Facilities	6
Shopping Center/Malls	3
Transporter or Offer of Hazardous Materials	202

Figure 3-12: Critical Facilities

Chapter 4

Floods

"Floods are the most common and widespread of natural disasters — except fire."[7] Floodwaters can move at very rapid speeds and can be quite destructive. As little as six inches of moving water can cause people to be knocked from their feet and two feet of water can sweep away an automobile. Moving water can tear out mature trees, bridges and buildings.

Flooding occurs when it rains or snows, and some of the water is retained by the soil and vegetation and the remainder, which cannot be absorbed, runs off the land in quantities that cannot be carried in stream channels or retained in natural ponds and constructed reservoirs or dams. Floodplains are areas where flooding occurs naturally. Rivers and streams within floodplains overflow their banks due to heavy rain or melting snow.

In Greene County, flooding is most common from April through August when severe thunderstorms bring heavy amounts of rain over a very short period of time or extended periods of rain over a several day period, which cause standing water and/or runoff problems. As such, all jurisdictions in Greene County are susceptible to flooding and participate in the National Flood Insurance Program.

Greene County has several rivers with smaller tributaries that are susceptible to annual flooding events. However, since 1964, Greene County has been fortunate in that no deaths or injuries have been reported due to flooding, but over $11 million[8] in damages have occurred due to flooding in that same period (Refer to Figure 3-1). Although the county has a history of flooding events, most events consist of little or no damage.

Year	Estimated Damages	Presidential Disaster Declaration
1964*	$3,400,000	Yes
1968*	$3,200,000	Yes
1989*	$4,300,000	Yes
1996	$3,514	No
2000	$4,270	No
2001	$59,100	No
2002*	$49,000	No

• Figure 4-1: Annual Total Flood Damage: Ohio Emergency Management Agency, National Climatic Data Center

[7] http://www.fema.gov/pdf/hazards/floodfs.pdf

[8] In some instances, damages for events are not necessarily reflective of Greene County estimates alone. Damages are reported for all areas listed under one reported event and may include several counties.

History of Flooding in Greene County

Most recently, on September 21, 2013, Greene County was affected by a large area of rain that caused isolated flooding, high water, and the closing of Factory Road.

In 2002, according to the National Climatic Data Center (NCDC), Greene County was affected by damages caused during heavy rainfall on September 27, 2002 due to the inland remains of Tropical Storm Isidore. A large area of tropical rains was dumped onto southwest and west central Ohio, the heaviest rainfall occurring in Butler, Clark, Clermont, Clinton, Greene, Hamilton, Miami, Montgomery, Preble, and Warren counties. Rainfall amounts for Greene and Montgomery Counties were between four and six inches over a several hour period causing numerous problems on area roadways.

The damage estimates for the areas affected by this storm were estimated at $25,500, but most damages occurred in the Cincinnati area where a roof collapsed over an antique store and motorists were stranded in their automobiles requiring rescue services.

Thunderstorms producing torrential rains in the amounts of four to six inches in four hours were reported in Clinton, Fayette, Greene, Montgomery, and Warren counties on July 27, 2002. These storms caused many creeks to flow out of their banks and damages were reported on the south side of Dayton and throughout Greene County. Total damages caused by this storm were estimated at $23,500.

Multiple thunderstorms developed over Clark, Greene, Montgomery, and Preble counties producing heavy amounts of rainfall in a brief period of time. This series of storms caused several road closures throughout the area and basements were flooded in the Kettering and Miamisburg areas, but there was no estimated dollar amount of property damage reported.

The most destructive event in Greene County occurred in May of 2001 when many roads were reportedly closed and a bridge just three miles southwest of Jamestown was washed out due to heavy rainfall causing $52,000 in damages.

No information is available for occurrences prior to April 29, 1996 from the NCDC, but records of three Presidential disaster declarations were available from the Ohio EMA. A Presidential disaster declaration was issued in June 1989 because severe storms caused flooding in Butler, Coshocton, Cuyahoga, Franklin, Geauga, Greene, Lake, Licking, Lorain, Mercer, Montgomery, Preble, and Warren counties causing an estimated $4.3 million in damages. In June 1968 a Presidential disaster declaration was issued to thirty-one Ohio counties including Greene for $3.2 million in damages caused by flooding on June 5th. Last, a Presidential declaration was issued for the estimated amount of $3.4 million for damages as a result of flooding in forty-seven counties in Ohio, including Greene, on March 24, 1964.

As reported and compiled by the Greene County Public Library, eleven flooding events occurred prior to the events recorded in the NCDC database. On May 26, 1989 — flash flooding along the Shawnee Creek, Sugarcreek, and Little Beavercreek resulted in some property damage. In 1973, flooding occurred along old U.S. 42 in Spring Valley. On January 29, 1959 heavy rainfall caused

flooding on the south side of Fairborn, along the Shawnee Creek in Xenia, the Little Sugarcreek, and along the Little Beavercreek across U.S. 35 and Factory Road. Many highways were closed as a result of this rainfall. In 1937, flooding along the Ohio River prompted discussion of a proposed dam on Ceasarscreek. The dam was completed January 3, 1978. On May 12, 1886 — periods of excessive rain caused severe flooding on the southern side of Xenia to Detroit Street. A 10 to 15 foot wall of water destroyed most of Barr's Bottom. Twenty-eight people died as a result of this day's events and most of the County's roads and bridges were washed out, and 5 miles of Little Miami railroad track was destroyed. Finally, on June 2nd, 1875 the Shawnee Creek flooded its banks after a two-hour rainfall. Most of the first floor of homes in Barr's Bottom was submerged, but no deaths resulted from these events.[9]

Hazard Probability

All jurisdictions within Greene County are vulnerable to flooding. Greene County has experienced, over the past 50 years, 9 documented flooding events that have caused significant damages. Based on the number of events identified and using the simplest formula possible, the number of events divided by the number of recorded years, there is a 18 percent chance that a flood event could occur somewhere in Greene County annually.

Hazard and Vulnerability Assessment

Southwest Ohio and Greene County are protected by the flood management system created by the Miami Conservancy District as a result of the Great Flood of 1913. The Miami Conservancy District is comprised of five dams and 11,800 acres along 55 miles of river channel in eleven communities along the Great Miami River.

Life and Property

Property is at risk due to flooding, resulting from rapid water movement. Rushing waters can tear out or down trees and utility poles. Saturated soil can cause trees to lose their ability to stand and fall across roadways or on houses, cars, utilities, and other property. Floodwaters can move with enough force to move buildings from their foundations or cause structural integrity failure or damage internal systems, i.e. electrical system damage and gas line ruptures. Foundations and basements can be severely damaged or cracked. Structures can be weakened and, even collapse.

Currents as a result of flooding are deceptive. Many of the deaths and injuries occur when individuals misjudge the force at which currents are moving. Six inches of water can move with enough force to sweep an adult off his feet and drag him to more treacherous areas. Two feet of moving water can sweep an automobile into more dangerous areas, trapping the motorist and passengers inside. Either episode could ultimately involve the drowning death of the victim.

[9] *Greene County, Ohio: Facts & Firsts.* 1994, Greene County Public Library.

The Federal Insurance and Mitigation Administration's Hazard Mapping Division maintains and

updates the National Flood Insurance Program (FIP) maps. The Federal Emergency Management Agency (FEMA) mapped the Floodway boundary, the 100-year floodplain boundary, and the areas of 500-year flood (areas subject to the 100-year flood with average depths less than 1 foot or with contributing drainage areas of less than 1 square mile and areas protected by levees from the 100-year flood) as illustrated on the NFIP maps.

CID	Name	Init FHBM Identified	Init FIRM Identified	Curr Eff Map Date	Reg-Emer Date
390876#	Beavercreek	09/04/81	08/02/82	03/17/11	08/02/82
390194#	Bellbrook	11/02/74	06/01/77	03/17/11	06/01/77
390607#	Cedarville, Village of	1/10/75	070/2/80	03/17/11	02/24/81
390678#	Clifton, Village of	08/08/75	07/02/80	03/17/11	07/08/80
390195#	Fairborn, City of	03/15/74	11/19/80	03/17/11	11/19/80
390881#	Jamestown, Village of		02/01/84	03/17/11	02/01/84
390196#	Spring Valley, Village of	1/16/73	08/01/80	03/17/11	08/01/80
390197#	Xenia, City of	12/23/77	01/02/81	03/17/11	01/02/81
390640#	Yellow Springs, Village of	10/18/74	09/04/85	03/17/11	09/04/85

• Figure 4-2: NFIP Participates – Greene County

For the purposes of this study, we will examine the structures in the Special Flood Hazard Area (SFHA) and the households and infrastructure, which lie in the 100-year floodplain. The 100-year floodplain is that area which has a one percent chance, on average, of flooding in any given year. The 500-year floodplain has a 0.2 percent on average chance of occurring.

Greene County is subject to weather related and repeated flooding, and FEMA reports that a total of 6,141 structures exist in these special flood hazard areas in Greene County, six of which are repetitive loss properties.

Community Name	Building Payments	Contents Payments	Total Payments	Average Payment	Losses	Properties
Fairborn, City of	69,332.02	0	69,332.02	11,555.34	6	1
Greene County*	27,024.57	12,025.17	39,049.74	4,881.22	8	3
Xenia, City of	77,239.05	88,852.52	166,091.57	27,681.93	6	2

In the 500-Year Flood Year Plan there are a total of 3,265 structures. All of these properties remain in the same vulnerable area to be flooded again and again. (Refer to Figure 4-1).

According to the FEMA flood maps, when overlaid with the Greene County parcel maps, there are 6,616 properties within the FEMA 100-year floodplain valued at nearly $1.3 billion. There are a possible 4,213 structures on those properties also in the floodplain with a total assessed value of $693,516,730. However, the State of Ohio reports there are some 2,109 structures with a total assessed value of $222,598,390 in the Special Flood Hazard Areas — 222 of these structures have been identified as businesses (Refer to Figure 4-3 for an aggregated list of the structures in the flood plain by jurisdiction). This equates to a possible 1,887 residential structures and 4,774 individuals when the average household size of 3^{10} persons per household residing in the flood plains.

Animals also suffer during flooding events. To some people, pets are a member of the family and

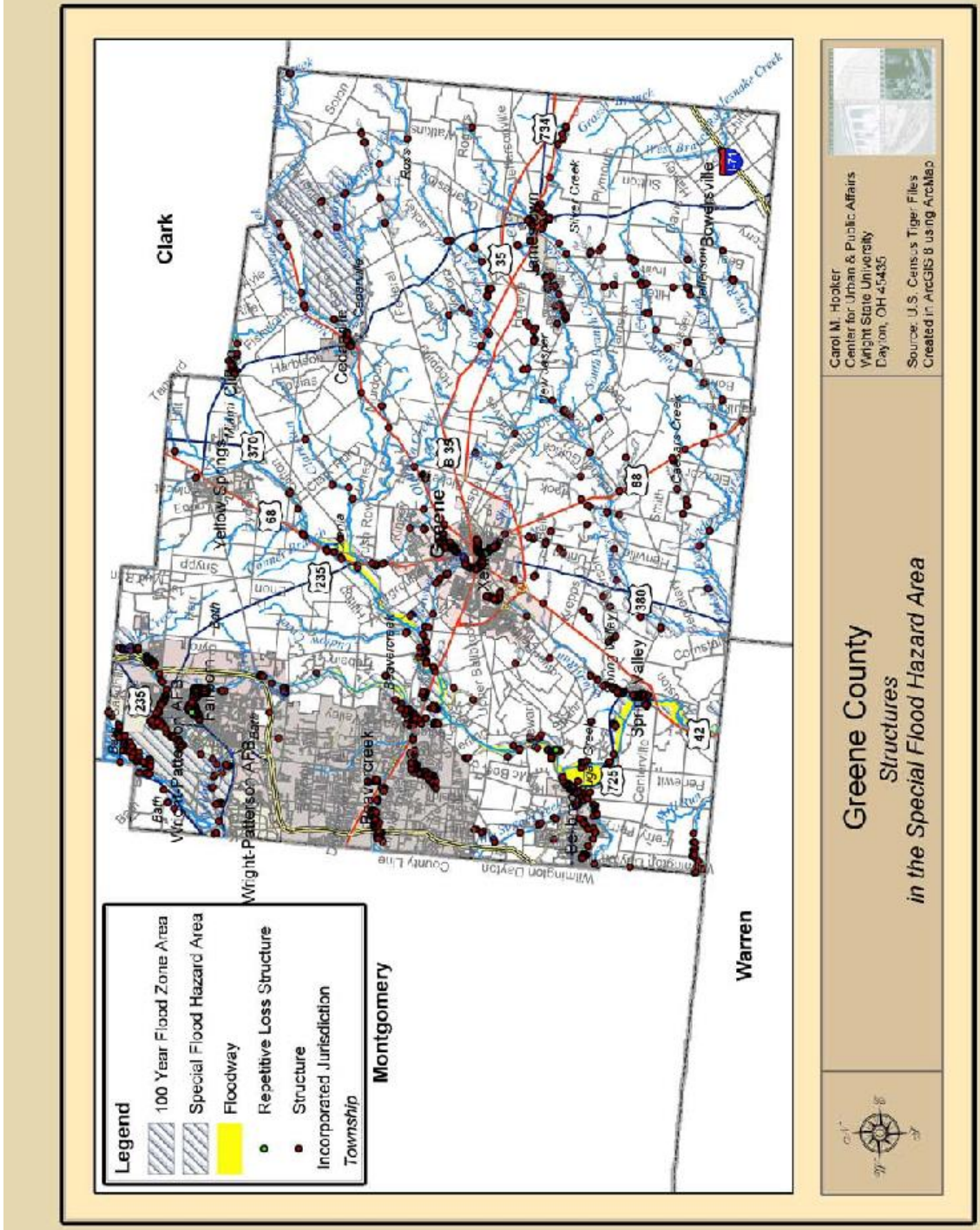
to others animals are an important way to earn a living. One way or another, animals are a large part of our lives; and their lives are frequently lost during flooding. Pet owners have been known to risk their own lives, refused to evacuate a disaster area, and/or hinder emergency rescue efforts to remain with or rescue their animals.

According to the American Pet Products Manufacturing Association (APPMA) 2011-2012 survey, 62% of American households own at least one pet. Of those households, 39% own at least one dog and 33% own at least one cat. The Humane Society of the United States reports pet owners own, on average, 1.7 dogs per household and 2.2 cats per household. This combined with the number of structures in the Special Flood Hazard Area presents 1,887 `households in the 100-year floodplain, which may own pets, a potential 958 cats and 676 dogs in harm's way.

Future Development

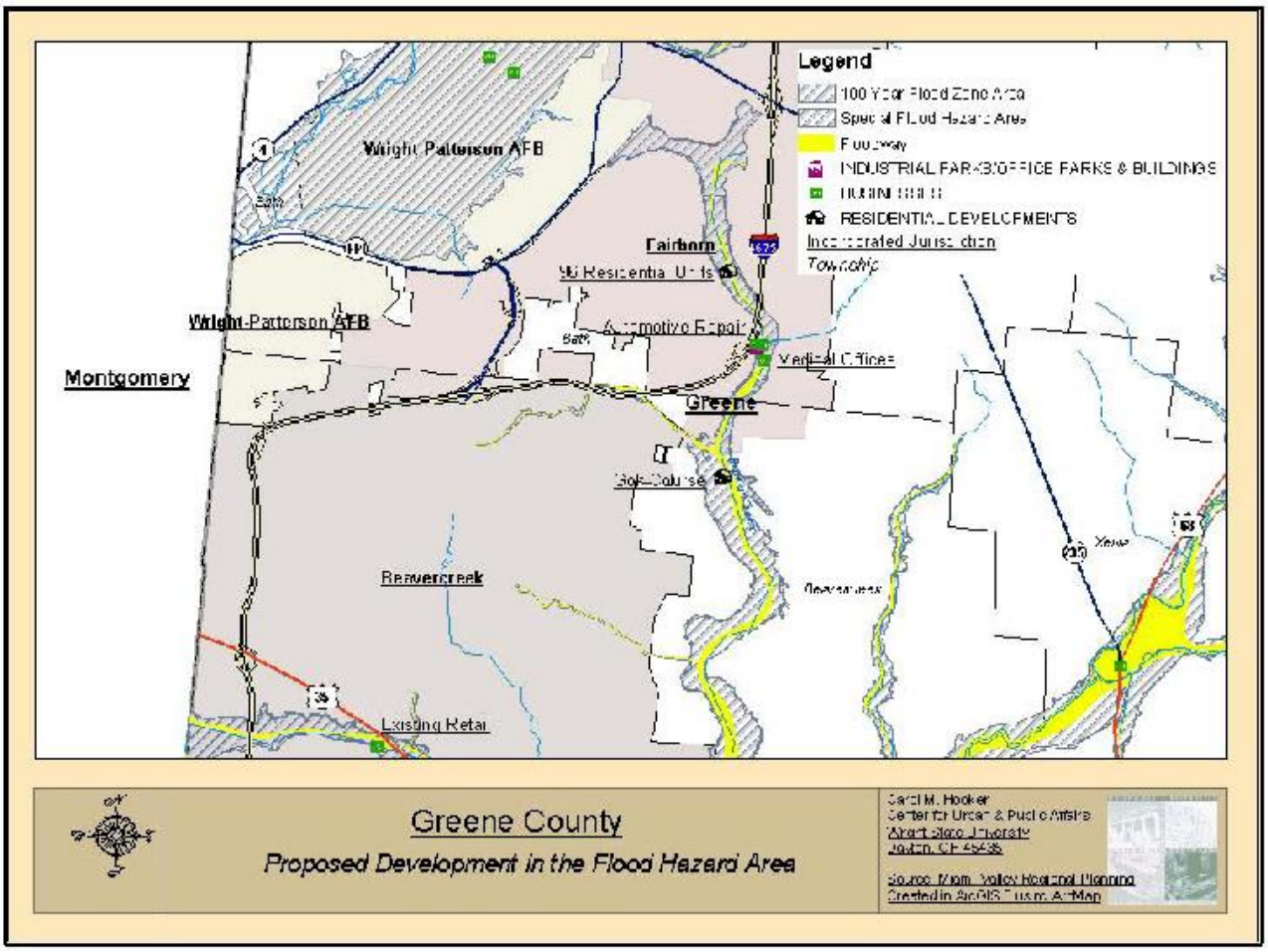
According to the FEMA flood maps, when overlaid with the proposed development data provided by the Miami Valley Regional Planning Commission (Refer to Figure 4-2.), there are 10 proposed developments within the FEMA 100-year floodplain. Two of these developments lie on Wright Patterson Air Force Base and are not included in this plan. Of the remaining eight developments, two are commercial office buildings or complexes, four are retail establishments, and two are classified as residential developments. One of the residential developments is a golf course and the other is a 96 unit residential development. This equates to an additional 243 individuals and 84 additional household pets residing in the flood plains.

[10] U.S. Census 2010, Average household size for Greene County



Source: http://www.dnr.state.oh.us

• Figure 4-3: Structures in the Special Flood Hazard Area



• Figure 4-4: Proposed Development in the Special Flood Hazard Area and the 100-year Flood Plain

Repetitive Loss Properties

Community Name	Building Payments	Contents Payments	Total Payments	Average Payment	Losses	Properties
Fairborn, City of	69,332.02	0	69,332.02	11,555.34	6	1
Greene County*	27,024.57	12,025.17	39,049.74	6,079.38	2	3
Xenia, City of	77,239.05	88,852.52	166,091.57	27,681.93	6	2

Businesses

In addition to the personal losses listed above, economic losses can also be expected. Business stands to lose structures due to flooding, as well as employees, productivity and deliverables. Two hundred twenty-two businesses are listed directly in the flood hazard area and fifteen of these businesses employ more than 50-99 employees and five estimate yearly sales over $10 million. (For further economic details, refer to figures 4-4 and 4-5).

Businesses Affected by Number of Employees		
Valid	1 To 49 Employees	193
	50 To 99 Employees	15
	100 To 249 Employees	2
	250 To 499 Employees	1
	Not Available	11
	Total	222

• Figure 4-6: Possible Number of Businesses and Employees Affected by SFHA Flood

Businesses Affected by Number of Reported Sales Volume		
Valid	Less Than $5 Million	158
	$5 To 10 Million	9
	$10 To 20 Million	5
	$20 To 50 Million	3
	$50 To 100 Million	1
	Not Available	46
	Total	222

• Figure 4-7: Possible Sales Impacted by SFHA Flood

Roads and Bridges

There are 395.09 miles of Greene County roads in the 100-year floodplains and a list by road type can be found in Figure 3-3. However, insufficient data is available at this time regarding whether these road/road systems exist in the floodplain or are over/above the floodplain.

Type	Miles
Interstate	6.44
U.S. Freeway	34.19
Ohio State Route	17.50
Local Roads	336.96
Total	395.09

• Figure 4-8: Greene County Roadways located in the 100-year Floodplain

Historically, flooded roadways have been the major cause of service interruption during storms. Roads are frequently flooded due to rapidly rising water. Roads are also often blocked by fallen trees during a flooding event, either directly caused by the flooding weakening the root system or by storm events leading to the flooding occurrence. Roadways can be uplifted and broken and as a result become impassable. Blocked roadways may have tragic consequences for people who need access to emergency services. The ability to travel after a natural hazard event is a priority issue for county residents, organizations, and providers of essential services such as hospitals and utilities.

Power Lines

Historically, falling trees have been the major cause of power outages resulting in interruption of services and damaged property. In addition, falling trees can bring electric power lines down, creating the possibility of lethal electric shock. Rushing water can also damage utility lines and cause prolonged power outages. Floods may inundate substations, forcing them to be shut down for extended periods of time to prevent major damage to the system. Rising population growth and new infrastructure in the county creates a higher probability for damage to occur from water damage as more life and property are exposed to risk.

Water

The most frequent water system problem related to flooding is a backup of the storm water sewer system. Backups frequently occur during severe thunderstorms, which cause flooding. The storm water backup can cause water and sewage to backup into basements or facilities. Floodwaters pick up sewage and chemicals from roads, farms and factories and can contaminate building finishes and worst of all, drinking water.

Vulnerability Assessment

Methodology. Hazards US – Multi Hazard (HAZUS-MH) version 2.1 built on an ArcGIS 10.0 platform with ArcView license was used to project a vulnerability assessment for 100-year return period for all watersheds (reaches) affecting and located in Greene County. The results are displayed from each HAZUS run in a format that is ready for input to Ohio EMA's State Hazard Analysis and Resource Planning Portal (SHARPP):

100-Year Return Period Scenario

Building Type	Number of Structures	Estimated Loss
Residential	4,075	$ 814,402,000
Non-Residential	1,550	$ 309,742,000
Critical Facilities	295	$ 59,332,000
TOTAL	**5,920**	**$ 1,183,476,000**

Chapter 5 Tornado & Winds

Tornadoes are nature's most violent storms. Spawned from powerful thunderstorms, tornadoes can cause fatalities and devastate a neighborhood in seconds. A tornado appears as a rotating, funnel-shaped cloud that extends from a thunderstorm to the ground with whirling winds that can reach 300 miles per hour. Damage paths can be in excess of one mile wide and 50 miles long. Every state is at some risk from this hazard. Some tornadoes are clearly visible, while rain or nearby low-hanging clouds obscure others. Occasionally, tornadoes develop so rapidly that little, if any, advance warning is possible. Before a tornado hits, the wind may die down and the air may become very still. A cloud of debris can mark the location of a tornado even if a funnel is not visible. Tornadoes generally occur near the trailing edge of a thunderstorm. It is not uncommon to see clear, sunlit skies behind a tornado.

The United States experiences an average of 100,000 thunderstorms each year and approximately 1,000 tornadoes develop from these storms. In the United States, tornadoes occur in all 50 states. However, tornadoes are most frequent in the Midwest, where conditions are most favorable for the development of the severe thunderstorms that produce tornadoes.

Tornadoes can be nearly invisible, but become visible when a funnel forms of water vapor or by swirling debris at the base of the funnel. Extremely violent tornadoes may break into several smaller funnels.

Fujita Scale		Enhanced Fujita Scale* * In use since 2007	
F–0	40–72 mph winds	EF–0	65–85 mph winds
F–1	73–112 mph	EF–1	86–110 mph
F–2	113–157 mph	EF–2	111–135 mph
F–3	158–206 mph	EF–3	136–165 mph
F–4	207–260 mph	EF–4	166–200 mph
F–5	261–318 mph	EF–5	>200 mph

• Figure 5-1: Enhanced Fujita Tornado Scale

The worst tornado disasters in the United States have claimed hundreds of lives. The Tri-State Outbreak of March 18, 1925, had the highest death toll: 740 people died in 7 tornadoes that struck Illinois, Missouri, and Indiana. The Super Outbreak of April 3-4, 1974, spawned 148 tornadoes (the most in any known outbreak) and killed 315 people from Alabama north to Ohio. From 1950 to 2011 a total of 42 tornadoes of F4 or F5 intensity have struck in the State of Ohio and killed 143 people, injuring 2,959, and causing property damages in excess of 1.4 billion dollars.

Two of these killers have destroyed property and lives in Greene County. The first, part of the Super Outbreak of April 3-4, 1974, killed 36 and injured 1,150. A $45.5 million Presidential Disaster was declared for 14 counties in Ohio affected by the tornadoes on April 3-4. The second such event occurred September 20, 2000. An estimated $16 million in damages were incurred and one person was killed and 100 were injured. Again a Presidential disaster was declared in Xenia totaling $13 million.

Twenty tornadoes were reported in Greene County, Ohio since 1884. These tornadoes caused 43 deaths, 1,377 injuries and over $1 billion dollars of damage. Xenia was the location of seven tornadoes, responsible for the majority of the fatalities and caused the highest amount of damage. The following is a list of the tornadoes that have occurred in Greene County since 1884.

Tornado Hazard Assessment

TORNADOES, FUNNEL CLOUDS, AND SEVERE WIND STORMS EVENT RECORD

May26/2015 Beavercreek F-0 Tornado

May 15, 2014 Cedarville Township F-3 Tornado

May 23, 2011 TORNADO

An EF1 Tornado touched down and caused damage to trees. No injuries were reported.

May 8, 2008 TORNADO

An EF0 Tornado touched down briefly in Jamestown. No injuries were reported.

September 14, 2008 SEVERE WIND STORM ASSOCIATED WITH TROPICAL DEPRESSION IKE

Greene County sustained winds to 54 m.p.h. with gusts to 75 m.p.h. As a result, all jurisdictions within Greene County had down trees, power line and power outage that in some areas lasted 14 days. Greene County was included in a federal declaration FEMA-DR-1805. Under the declaration, affected local governments became eligible to apply for federal assistance to supplement local response efforts to the storm.

August 9, 2001 FUNNEL CLOUD

A funnel cloud was observed but never touched down near Fairborn. There were no injuries or property damage reported.

September 20, 2000 TORNADO

A violent tornado that moved at 65 mph hit the town of Xenia. Along the path of the tornado,

around 250 homes were either damaged or destroyed, over 40 businesses were damaged or destroyed including the local Wal-Mart, Kroger, Tire Discounters, and 6 churches were damaged. A strip mall was nearly destroyed, cars were thrown from the Highway 35 bypass into ditches, 4 semi-trailers were thrown up to 400 yards, and most of the buildings were damaged or destroyed at the Greene County fairgrounds. Over 10,000 residents lost power for at least a day. There were 100 injuries, one fatality and the property damage was estimated at $16 Million. The event was declared a federal disaster and the county received $4.8 million in federal funding to help with reconstruction.

May 7, 1998 TORNADO: A tornado briefly touched down ripping a roof off of a home and knocking down numerous trees in Xenia. There were no injuries or fatalities and the property damage was estimated at $11,200.

July 2, 1997 TORNADO: Two miles North of New Jasper a brief tornado developed in the apex of a bow echo that moved across the county. A house was blown off its foundation and moved 35 feet away. A low pressure system with an unusually strong mid and upper level jet streak was moving across the Great Lakes with an associated cold front moving across the upper Ohio Valley. The tornado and the storm associated with it caused extensive wind damage estimated at $57,000. There were no fatalities or injuries reported.

April 25, 1989 TORNADO : A tornado touched down in the Xenia area for five miles with a width of 123 yards. This tornado destroyed six houses, damaged 106 houses and ten businesses. This tornado and the storm associated with it caused property damage estimated at $3.7 million and 16 injuries were reported.

May 9, 1988 TORNADO

A small tornado briefly touched down in Hoop Road area in Xenia. No damage was reported.

May 29, 1982 TORNADO

A tornado touched down in Sugarcreek Township causing property damage estimated at $476,000. There were no reported fatalities or deaths associated with this tornado.

August 3, 1980 TORNADO

A tornado traveled on the ground for one mile in Fairborn. The tornado overturned an Air Force vehicle, damaged several roofs and downed power lines. The storm caused $812,000 in damages to the area. There were no fatalities or injuries reported.

April 3, 1974 TORNADO

A deadly tornado touched down in Xenia for 20 miles killing 36 people, injuring 1,150 and doing $932 million dollars in damage. 1400 homes were damaged, 184 businesses, 9 churches and 3 schools, including the high school, were destroyed. Several counties were affected and it was declared a federal disaster. The federal government gave the region $45.5 million dollars.

May 10, 1969 TORNADO

A tornado was reported traveling for seven miles in Beavercreek Township, Heather Trails Section. Several homes and a nursing home were damaged. The tornado injured six.

October 9, 1966 TORNADO

A tornado that stretched for five miles was reported in the southeast side of Beavercreek to the east side of Xenia in Greene County. It caused a reported $1.4 million in property damage and caused three injuries. There were no fatalities reported.

April 11, 1965 TORNADO

A tornado touched down in Cedarville Township causing $146,000 in property damage. There were no reports of injuries or fatalities.

June 23, 1964 TORNADO

A tornado touched down just east of Xenia in Xenia Township that was 33 yards wide that caused $148,000 in property damage. No injuries or fatalities were reported.

April 19, 1963 TORNADO

A tornado caused over $1.5 million in property damage. There were no injuries or fatalities reported.

February 25, 1956 TORNADO

A tornado hit Cedarville and went through the center of town. It destroyed an American Legion Hall, damaged 30 homes and 15 businesses with an estimated cost of about $6.8 million. Wind gusts were reported up to 70 MPH. There were no injuries or fatalities reported.

April 5, 1947 TORNADO

A small tornado touched down in Osborn. There was minor damage to homes and a few downed power lines.

May 13, 1933 TORNADO

A severe tornado struck Xenia killing one and injuring 35. Many homes were destroyed with property damage estimated at the time (1933) to be $707,000 – $1 million.

May 12, 1886 TORNADO

A severe storm that caused a flood also spawned a small tornado five miles north of Xenia. No property damage, injuries or fatalities were reported.

April 27, 1884 TORNADO

A severe storm accompanied by a tornado caused substantial damage to homes in Jamestown. Almost all buildings sustained some damage and 600 people were left homeless. It was responsible for 100 injuries and five deaths. Property damage was estimated at the time (1884) at $5.1 million.

Hazard and Vulnerability Assessment

According to the Disaster Center, Ohio is ranked fifth in the nation when considering frequency of tornadoes, number of fatalities, number of injuries, and cost for damages for tornado disasters.[14] The Disaster Center bases its risk assessment on data collected from 1950-1995, dividing the square mileage of each state against the frequency of death, injury, number of tornadoes, and cost of damages for each state.

Tornadoes do not discriminate. They strike everything in their path, potentially destroying everything in their path — homes, loved-ones, livelihood, infrastructure & natural areas. When we consider tornado risk, it is impossible to consider the likelihood of a tornado striking a particular area because tornado strikes are random events, but the risks of death, injury and the costs of tornadoes for locations can still be hypothesized and estimated. Tornados cannot be predicted, but the conditions that cause them can be identified.

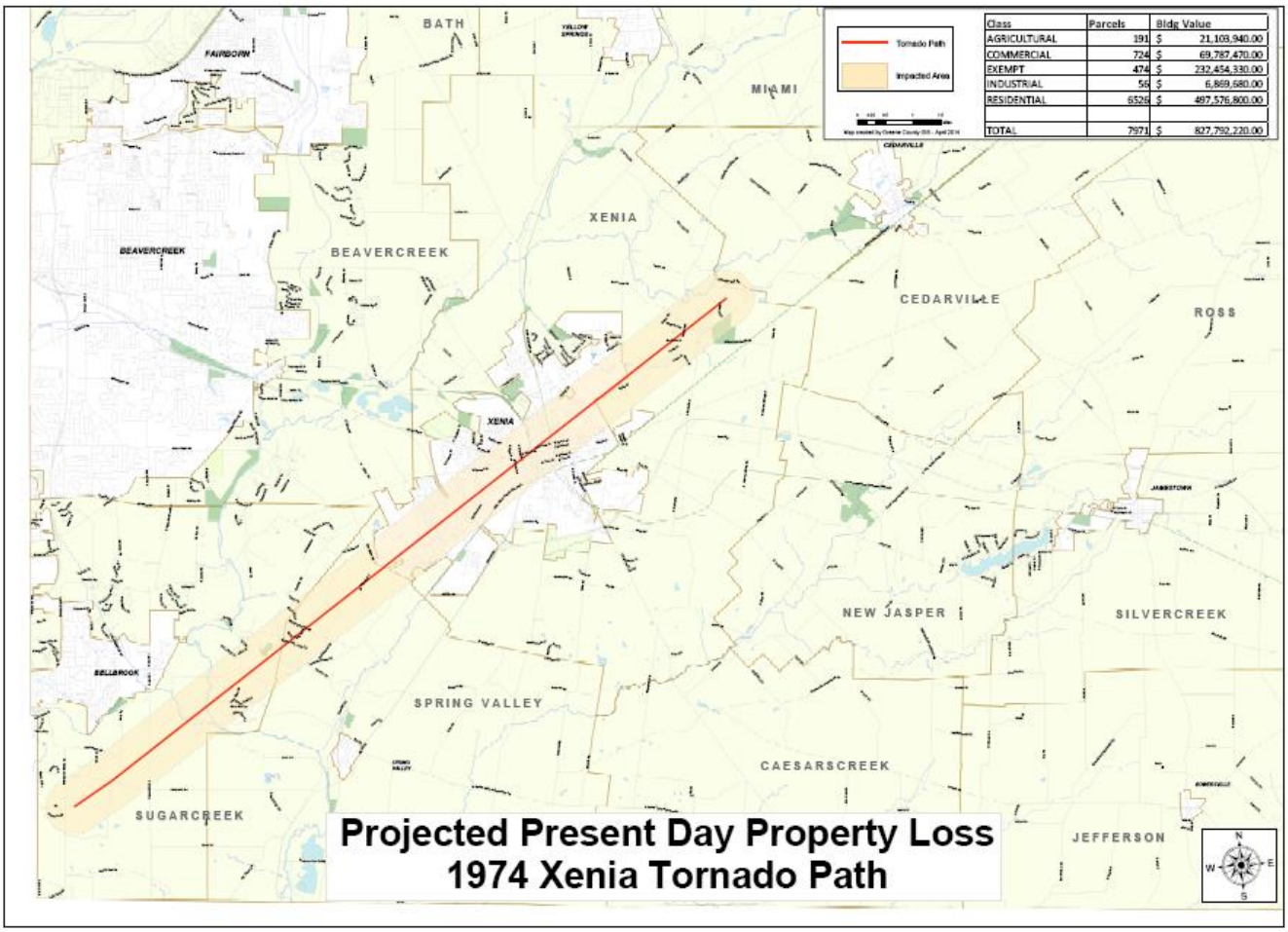
Hazard Probability

Tornados are a countywide hazard and have the potential to affect all jurisdictions within Greene County. In the last 64 years, Greene County has experienced 16 documented tornadoes. Using the simplest formula possible, the number of events divided by the number of recorded years, there is a 25 percent chance that a tornado could occur somewhere in Greene County annually.

In order to analyze the worst case tornado scenario for Greene County, we used the path of the 1974 tornado. If an EF5 tornado were to strike on a path similar to the one mapped in Figure 5-4, the tornado's path would go through Bellbrook, Sugarcreek Township, Beavercreek Township, Xenia, Xenia Township, and Cedarville Township. If such an event were to occur, it would impact a population of 51,300 and 6,326 residential properties. If lost, the value of the residential properties that would be in this path would be valued at $497,576,800. In addition, 724 commercial and 56 industrial properties would be in this path with a loss value of approximately $76,657,150. In addition, there is 474 Exempt Class properties with a loss value of $232,454,330. This path also includes one hospital, County and City Offices, Xenia Police and Fire Station and two universities. This scenario estimates the losses as a direct result of the tornado, but does not include the potential loss from the accompanying storm.

Validity of this data is tenuous. The total population of those in the tornado's path is listed as the total of all individuals in those Census blocks that intersect the path in any capacity, not just those individuals who actually live in the path. In other words, the total number of individuals living in the tornado's path is likely overstated.

Greene County Tornado Scenario



• Figure 5-2: F5 Tornado Model across Greene County's Population Center

Vulnerability Analysis

Building Exposure for Greene County – Tornado

Building Type	Number of Structures	Estimated Loss
Residential	6,326	$ 479,576,800
Non-Residential	780	$ 76,657,150
Critical Facilities	474	$ 232,454,330
TOTAL	**7,580**	**$ 788,688,280**

Chapter 6

Hail

Thunderstorms occasionally produce damaging hail. While fatalities and injuries rarely occur, hailstorms are the cause of millions of dollars in damage each year. Hail is a countywide hazard and affects all jurisdictions and all areas of the country.

Hail is precipitation in the form of a chunk of ice that can fall from a cumulonimbus cloud. Usually associated with multi-cell, super-cell and cold front induced quall line thunderstorms, most hail fall from the central region of a cloud in a severe storm.

Hail begins as tiny ice pellets that collide with water droplets. The optimum freezing level from the formation of hail is from 8,000 to 10,000 feet. The water droplets attach themselves to the ice pellets and begin to freeze as strong updraft winds toss the pellets and droplets back up into the colder regions of the upper levels of the cloud. As the attached droplets freeze, t he pellets become larger. Both gravity and downdraft thunderstorm winds pull the pellets back down, where they encounter more droplets that attach and freeze as the pellets are thrown, once again, back up through the cloud.

To create pea-size hail (about 1/2 inch in diameter) winds within the thunderstorm updraft will generally be around 20 miles per hour. Quarter size hail (3/4 of an inch in diameter) requires updrafts of about 40 miles per hour. Golf ball size hail (1 3/4 inches in diameter) needs updrafts of around 55 miles per hour.

HAILSTONES

The more times a hailstone is tossed up and down through the cloud, the larger the hailstone will be. Hailstones the size of softballs had many more trips up and down through the cloud than pea-sized hailstones. Large hailstones are an indication of powerful updraft and downdraft winds within a thunderstorm. This is why large hail is associated with severe thunderstorms. The largest hailstone ever measured in the United States fell at Coffeyville, Kansas, on September 3, 1970. It weighed 1.67 pounds and measured 17.5 inches in circumference. [11]

[11] Weather.com - http://www.weather.com/encyclopedia/thunder/hail.html

Hail Hazard Assessment

Hazard Probability

Greene County has reported 59 hailstorms since 1950. Based on the simplest formula there is a 92 percent chance there will be a hailstorm annually in Greene County. Of these, 59 identified storms, only four of the hailstorms reported property damage and there were no reports of injuries or deaths. The most recent was on May 25, 2011. Statewide preliminary estimates find that insurance companies racked up losses totaling $322-400 million from the May 20-26 storms. According to the Ohio Insurance Institute (OII)[12] this is the third costliest natural disaster to hit the Buckeye state in recent times, behind the April 3-4, 1974 Xenia tornado super-outbreak and the September 14, 2008 Hurricane Ike windstorm. The number of Ohio claims filed as of June 2011 was an estimated at 68,000-77,000.

Listed below are the four hailstorms that caused property damage:

DAMAGING HAIL STORMS IN GREENE COUNTY

May 25, 2011 HAIL

Some intense thunderstorms developed over the Ohio region during the afternoon hours of May 25. Three-inch hail was reported in the Bellbrook, and Xenia.
OII preliminary May storm loss estimates 25 property/casualty insurance companies participated in the OII May 20-26 storm survey. They represent about 82 percent of Ohio's personal auto market, 79 percent of the homeowners' insurance market and nearly 31 percent of Ohio's commercial lines market based on 2009 Ohio premium volume. Initial insurance company claims estimates ranged from three to 17,000. Losses reported by companies varied from $15,000 to $101.5 million.

April 28, 2002 HAIL

A storm with hail measuring .75 inches caused $5,100 worth of property damage to the region. Most of the damage occurred in Jamestown. Some intense thunderstorms developed over the Ohio region during the afternoon hours of May 25. Three-inch hail was reported in the Bellbrook, and Xenia.

June 12, 1999 HAIL

A storm with hail measuring an inch in diameter fell near the county line near Beavercreek. The property damage was estimated at $1,100 occurring in Bellbrook.

June 22, 1995 HAIL

A storm with hail measuring .75 inches caused $7,200 in property damage to the western part of Greene County. Trees and large limbs were downed in several locations.

[12] Ohio Insurance Institute

Hail Hazard and Vulnerability Assessment

A rare but costly hailstorm caused an estimated $400 million in insured losses with 77,000 on May 25, 2011 in the State of Ohio, Greene County jurisdiction were also included in these losses. Some intense thunderstorms developed over the Ohio region during the early evening hours. Three-inch hail was reported in the south Dayton area. In the late evening and early overnight hours (into May 26), a strong line of thunderstorms moved eastward through the state. The line produced winds in the 40-60 MPH range, according to the NWS Wilmington. The storms caused wind and hail damage to roofs, gutters, siding, windows and outdoor property. The high number of auto claims (40 percent of preliminary figures) were primarily due to extensive hail and wind damage from fallen limbs and flying debris.

OII preliminary May storm loss estimates

Initial insurance company claims estimates ranged from three to 17,000. Losses reported by companies varied from $15,000 to $101.5 million. Not all insurance companies are represented by OII's survey so final losses will likely be higher than these preliminary estimates. Both OII and PCS expect to conduct resurveys toward the end of 2012 to firm up insured loss information from these storms.

Claim estimates: 67,955

- Homeowners: 38,597
- Auto: 27,387
- Business: 1,971

Loss estimates: $322.1 million

- Homeowners: $214.9 million
- Auto: $80.4 million
- Business: $26.9 million

Based on OII findings, 57 percent of claims reported to-date pertained to homeowners or renters insurance. The storms caused wind and hail damage to roofs, gutters, siding, windows and outdoor property. The high number of auto claims (40 percent of preliminary figures) were primarily due to extensive hail and wind damage from fallen limbs and flying debris.

Using the figures provided by the Ohio Insurance Institute, we arrive at an estimated average damage claim of $8,345.21 in 2011. It is entirely possible for a hailstorm to hit an entire community in any given storm event. Therefore, in figure 6-1 estimates losses if every household in any given Greene County community was hit by a hail storm.

Jurisdiction	Population	Owner Occupied Residential Structure	$8,345 loss x Owner Occupied Structures
Beavercreek, City of	45,193	13,474	112,440,530
Bellbrook, City of	6,943	2,259	18,851,355
Fairborn, City of	32,352	7,250	60,501,250
Xenia, City of	25,719	6,400	53,408,000
Bowersville, Village of	290	88	734,360
Cedarville, Village of	4,019	346	2,887,370
Clifton, Village of	104	34	283,730
Jamestown, Village of	1,993	474	3,955,530
Spring Valley, Village of	479	154	1,285,130
Yellow Spring, Village of	3,487	1,074	8,962,530
Bath Township	8,241	1,033	8,620,385
Beavercreek Township	5,762	1708	14,253,260
Caesarscreek Township	1,137	392	3,271,240
Cedarville Township	1,481	439	3,663,455
Jefferson Township	942	281	2,344,945
Miami Township	1,199	375	3,129,375
New Jasper Township	2,568	882	7,360,290
Ross Township	750	236	1,969,420
Silvercreek Township	1,745	578	4,823,410
Spring Valley Township	2,102	795	6,634,275
Sugarcreek Township	8,039	2,334	19,477,230
Xenia Township	6,537	1,708	14,253,260

- Figure 6-1 Hail Storm Estimate Losses

Vulnerability Analysis

Building Exposure for Greene County – Hail Storm

Building Type	Number of Structures	Estimated Loss
Residential	2,234	$ 23,378,450
Non-Residential	200	$ 19,839,773
Critical Facilities	10	$ 10,000,000
TOTAL	**2,444**	**$ 523,218,223**

Chapter 7 Severe Winter Storm

Severe winter storms pose a significant risk to life and property in Greene County by creating conditions that disrupt essential regional systems such as public utilities, telecommunications, and transportation routes. Severe winter storms can produce freezing rain, ice, snow, cold temperatures, and wind. Ice storms accompanied by high winds can have destructive impacts, especially to trees, power lines, and utility services. Severe freezes occur when high temperatures remain below freezing for more than five days. Severe snowstorms occur less frequently, but have a widespread impact on people and property in Greene County.

Greene County Winter Storm Issues

Life and Property

Winter storms are deceptive killers. Many of the deaths that occur are indirectly related to the actual storm, including deaths resulting from traffic accidents on icy roads, heart attacks while shoveling snow and hypothermia from prolonged exposure to the cold.

Property is at risk due to flooding and landslides resulting from heavy snowmelts. Ice, wind, snow, and falling trees and limbs can impact trees, power lines, telephone lines, and television and radio antennas. Saturated soil can cause trees to (1) lose their ability to stand and (2) fall on houses, cars, utilities, and other property. Similarly, if streets are icy, it is difficult for emergency personnel to travel and may pose a secondary threat to life if police, fire, and medical personnel cannot respond to calls.

Property is also at risk when snow loads cause structural integrity failure. Roofs can collapse under the additional weight of heavy snow. Snow banks also collapse causing road hazards or even burying individuals.

Roads and Bridges

Snow and ice events resulting in icy road conditions can lead to major traffic accidents. Roads blocked by fallen trees during an ice storm or windstorm may have tragic consequences for people who need access to emergency services. The ability to travel after a natural hazard event is a priority issue for county residents, organizations, and providers of essential services such as hospitals and utilities.

Power Lines

Historically, falling trees have been the major cause of power outages resulting in interruption of services and damaged property. In addition, falling trees can bring electric power lines down, creating the possibility of lethal electric shock. Snow and ice can also damage utility lines and cause prolonged power outages. Rising population growth and new infrastructure in the county creates a higher probability for damage to occur from severe winter storms as more life and property are exposed to risk.

Water Lines

The most frequent water system problem related to cold weather is a break in waterlines. Breaks frequently occur during severe freeze events when water expands in the pipes as it freezes, as well as during extreme cooling periods during the months of October, November, and December. Another common problem during severe freeze events is the failure of commercial and residential water lines. Inadequately insulated portable water and fire sprinkler pipes can rupture and cause extensive damage to property.

Severe Winter Storm Hazard Assessment

Hazard Identification

A severe winter storm is generally a prolonged event involving snow, ice, and or extended periods of extreme cold. The characteristics of severe winter storms are determined by the amount and extent of snow or ice, air temperature, wind speed, and event duration. If a severe ice storm occurs in Greene County, there may be prolonged power outages over widespread areas. The following is a list of the severe winter storms that affected our region including snowstorms, ice storms and extreme cold.

SNOW STORMS

March 7 – 9, 2008

Greene County had a record snow fall which resulted in an Emergency Disaster Declaration. The president declared on April 24, 2008 for public assistance, (EM-3286) for Greene County and other effected counties in Ohio. Local government incurred cost for snow removal.

December 22 – 24 2004

Greene County had a record snow fall which resulted in an Emergency Disaster Declaration. The president declared on January 11, 2005 for public assistance, (EM-3198) for Greene County and other effected counties in Ohio. Local government incurred cost for snow removal.

February 14-17, 2003 SNOWSTORM

A blizzard brought over twelve inches of snow for most parts of Southern Ohio. Some areas had snow accumulations of 12 inches and there were wind gusts of up to 35 mph at times. On March 14, 2003 the president approved the request for federal disaster aid. Local government incurred costs of at least 17 million dollars and more than $500,000 dollars was awarded in aide to homeowners.

January 19-20, 2000 SNOWSTORM

A fast-moving low-pressure system brought a band of heavy snow across central and southern Ohio. Many locations received 5-6 inches while the heaviest band of 7 inches fell from Dayton to Xenia to Chillicothe. No injuries or property damages were reported.

March 9, 1999 SNOWSTORM

Low pressure brought abundant moisture northward into an arctic air mass producing very heavy snow. The heaviest snow fell between midnight and 8:00 am with snowfall rates of 1-2 inches an hour at times. The snow continued into the daylight hours but it was generally much lighter. Accumulations ranged from 5 to 10 inches with the highest amounts occurring on a line from Hamilton to Wilmington to Chillicothe. No injuries or property damage were reported.

January 13-14, 1999 SNOW AND ICE STORM

A low-pressure system brought abundant moisture northward from the Gulf of Mexico. At the same time, an arctic high-pressure system forced low-level cold air southward. The rain changed to freezing rain first across the northern Miami Valley where up to 1 inch of ice accumulations occurred. Then, the freezing rain changed to snow with 3 to 6 inches of accumulations occurring. Around Dayton and Columbus, the rain changed to freezing rain with up to ½ inch of ice accumulation occurring. Eventually, the freezing rain changed to sleet with up to ½ inch of accumulation occurring. No injuries or property damage were reported.

January 7-9, 1999 SNOWSTORM

A weak low-pressure system brought an area of wintry precipitation to parts of central and southern Ohio. The precipitation began as a period of snow with 2 to 4 inches of accumulation occurring. After a period with no precipitation, freezing rain began with some significant accumulation occurring. No injuries or property damage were reported.

January 1-2, 1999 SNOWSTORM

A major winter storm affected much of Ohio beginning late on the 1st and continuing through much of the 2nd. Heavy snow fell initially with some areas receiving greater than 1 inch an hour rates. Some thunder was reported with some of the heaviest snow around Cincinnati and Dayton. By early afternoon on the 2nd, much of the snow had changed to a mixture of sleet and freezing rain.

However, by that point the snow had accumulated to 6 to 10 inches. No injuries or property damage were reported.

March 19-21, 1996 SNOWSTORM

On the first day of spring a major winter snowstorm struck the region. Low-pressure moving slowly across Pennsylvania was responsible for snow, and this also brought strong winds with gusts up to 40 mph. It was heavy wet snow, which ripped down power lines and trees. Highways became snow covered and slippery causing numerous traffic accidents. Snow amounts ranged between 4 and 8 inches.

January 11-12, 1996 SNOWSTORM

A fast moving low-pressure system tracked from the Mid Mississippi Valley to the Kentucky Tennessee border. This storm brought a fairly wet snow to the area. Total snow accumulations were near 4 inches. No injuries were reported, but property damage for the region was reported at $30,500.

January 6-8, 1996 SNOWSTORM

The Blizzard of 1996 developed near the Gulf Coast and moved up the East Coast. This massive system produced accumulations of snow over 14 inches in some areas. The average snowfall for our area in an entire season is 23 inches areas making this blizzard the worst storm since 1978. By the end of the storm many homes and businesses had their roofs collapse or partially collapse from the weight of the new snow, and snow from a storm earlier in the week. By late in the day on the seventh arctic air was pouring into the region. Some areas had 30 continuous hours of snowfall and wind gusts approaching 60 miles an hour causing extensive damage and two fatalities in our region. The property damage for the region was estimated at $16.8 million.

January 2-3, 1996 SNOWSTORM

Low pressure strengthening in the Tennessee valley passed southeast of Ohio. There was a messy mix of precipitation. Roads oriented east to west were quite hazardous with wind gusts from the north up to 40 mph causing snowdrifts shortly after these roads were plowed. Some areas had drifts between 3 and 5 feet. Temperatures during much of this event were in the upper teens and 20s. The property damage for the region was estimated at $880,000.

December 19, 1995 SNOWSTORM

The first major snow storm of the season developed as a deep low-pressure system tracked from the Lower Mississippi Valley to the Mid-Atlantic States. Rain changed to snow, with a period of sleet and freezing rain. Snow accumulations ranged between 4-5 inches. Blizzard conditions were experienced in some areas. This caused many power outages and the damage for our region was estimated at $121,000. No injuries were reported.

January 21-22, 1995 SNOWSTORM

An extended period of snow accumulated three to six inches. Northwest winds caused blowing and drifting snow and made travel on secondary roads difficult and dangerous. There were power outages from downed wires due to wind and snow. Numerous traffic accidents were reported. There were six injuries and two fatalities reported for our region and the property damage were estimated at $604,000.

March 9-10, 1994 SNOWSTORM

Snow accumulated an average of four to six inches with some higher hills receiving eight inches. Snow occasionally mixed with sleet and freezing rain. Some trees and power lines were downed due to the weight of the ice and snow. Property damage for the region was estimated at $621,000.

January 26-28, 1978 SNOWSTORM

This blizzard began in the early morning of January 26, and was accompanied by winds exceeding 70 mph creating 12-foot snowdrifts. This blizzard is referred to as the "Blizzard of 1978." The entire state was declared by the president as a federal disaster area with damages estimated at $9.9 Million. 2,000 National Guard troops evacuated thousands of Ohioans. The American Red Cross Shelters and hotels were filled with stranded motorists.

ICE STORMS

February 1, 2011 ICE STORM

An ice storm occurred after a strong surge of moisture moved north into the Ohio valley during the morning hours. Temperatures were at or just below the freezing mark for several hours while rain fell. Roads quickly became icy during the morning rush hour causing numerous traffic accidents. DP&L reported approximately 42,000 customers were without power. Outages required extensive reconstruction. The outages were concentrated south of I-70, primarily in the Dayton Metro area. Hardest hit were areas where ice accumulated in Kettering, Oakwood, Bellbrook and Beavercreek. Red Cross opened numerous shelters for those without power.

March 26, 2002 ICE STORM

A warm front bisected the state of Ohio along and just south of the I-70 corridor. A low-pressure system moved along the boundary, bringing widespread freezing rain. Numerous areas received a half-inch of ice that brought down trees and power lines, and caused several accidents due to slippery roads.

December 13-14, 2000 ICE STORM

A week low-pressure system brought freezing rain to the region. Widespread ice accumulations of one-quarter to one-half inch occurred. No injuries or property damage was reported.

January 13-14, 1999 SNOW AND ICE STORM

A low-pressure system brought abundant moisture northward from the Gulf of Mexico. At the same time, an arctic high-pressure system forced low-level cold air southward. The rain changed to freezing rain first across the northern Miami Valley where up to 1 inch of ice accumulation occurred. Then, the freezing rain changed to snow with 3 to 6 inches of accumulation occurring. Around Dayton and Columbus, the rain changed to freezing rain with up to ½ inch of ice accumulation occurring. Eventually, the freezing rain changed to sleet with up to ½ inch of accumulation occurring. No injuries or property damage were reported.

January 24, 1997 ICE STORM

An ice storm occurred after a strong surge of moisture moved north into the Ohio valley during the morning hours. Temperatures were at or just below the freezing mark for several hours while rain fell. Roads quickly became icy during the morning rush hour causing numerous traffic accidents. Several roads were closed due to one-quarter inch of ice accumulation. In Greene County alone, over 80 accidents were reported.

March 6-7, 1996 ICE STORM

North winds behind a cold front sagging across the region caused a shallow layer of below freezing air to penetrate deep into the Ohio Valley. Precipitation falling over the region changed from rain and drizzle to freezing rain and freezing drizzle, and then eventually to sleet and snow from north to south. Total snow accumulations were light, ranging from less than an inch to 3 inches. Numerous accidents occurred.

January 6-7, 1995 ICE STORM

Much of the area received one-quarter to one-half inch glaze of freezing rain and sleet. Some snow mixed in near the end of the event. It was the first major winter storm of the season and traffic accidents were widespread, many of which brought traffic to a stand-still and effectively closed roads. Localized power outages resulted from downed trees and wires. Although no direct fatalities occurred, at least four fatalities were the result of traffic accidents. 26 injuries were reported and the property damage was estimated at $483,000.

EXTREME COLD

February 1-5, 1996 EXTREME COLD

Arctic high pressure brought the coldest air of the season to the Ohio Valley. The extreme cold was entrenched for 5 days, freezing and bursting numerous water pipes and an extremely high number of cars that would not start because of the cold weather. The property damage for the region was reported at 1.5 million dollars.

December 9-11, 1995 EXTREME COLD

The first artic air outbreak of the season occurred across the state on the 9th, lingering through the 11th. Temperatures plummeted to overnight lows from the single digits below zero to the single digits above accompanied by 10-15 mph winds. The strong winds combined with the low temperatures produced wind chills as cold as 35 below zero. Property damage for the region was estimated at $2,400 and an 82-year-old women was found dead of exposure in her car on the morning of the 10th.

February 11-13, 1995 EXTREME COLD

Air spread across all of Ohio on the 11th producing low temperatures between zero and about 10 below on the morning of the 12th and close to zero on the 13th. There were four fatalities in the region caused by exposure and a number of water line breaks occurred. The property damage for the region was estimated at $121,000.

Hazard Probability

Winter storms are a countywide hazard and have the potential to affect all jurisdictions within Greene County. Greene County has experienced over 26 documented events that have caused damages since 1978. Based on the number of events identified and using the simplest formula possible, the number of events divided by the number of recorded years, there is a 72 percent chance that a severe winter storm, of some sort, could occur somewhere in Greene County annually.

Life and Property

Greene County is subject yearly to winter weather related fatalities and losses. All of Greene County is vulnerable to winter weather and treacherous conditions.

Property is at risk due pipes breaking caused by the freeze/thaw action frequently experienced in the winter months. Ice or snow loads can damage or tear out trees and down utility lines. Snow loads can severely damage roofs and they can be weakened and, even collapse.

Winter travel can be deceptive due to sleeting or ice storms. Many of the deaths and injuries occur when individuals misjudge the road and travel conditions, which can even lead to fatal automobile accidents.

For the purposes of this study, we will examine the claims reported to the Ohio Insurance Institute (OII) as they relate to winter hazards. OII loss estimates include the storm that passed through the state over President's Day weekend starting on February 14, 2003 and a subsequent winter storm the following week. The storms caused power outages, freezing pipes, and structural damage from ice, wind, water and heavy snow accumulation. As a result, insurance companies reported approximately 6,900 insured claims from the storms.

Approximately 59% of the claims made as a result of this storm were made by homeowners and renters. The average residential claim amounted to $2,252.

Businesses also suffered losses. Commercial property losses amounted to 136 claims and were estimated at slightly under $1 million (Approximately $7,353 per claim). Total losses could possibly range up to $357,898,805 if every business in the county filed a claim, at an average of $7,353.

Schools, some businesses, and local and state governments were closed on Ohio's heaviest snow day and in addition to property losses, businesses also suffer economic losses due to the periods in which they remained closed, lost sales, and lost production. None of which cannot be calculated here.

The Ohio and Federal Emergency Management Agencies and US Small Business Administration surveyed damage in southern Ohio, making a preliminary assessment of $17 million in disaster related costs. These costs include snow and debris removal, emergency loss prevention measures and public utilities repair. None of which will be estimated in this chapter.

For a more detailed look by jurisdiction of the estimated residential losses (expressed in number of residential units and estimated dollars), please refer to figure 7-1.

Jurisdiction	Population	Owner Occupied Residential Structure	$2,253 loss x Owner Occupied Structures
Beavercreek, City of	45,193	13,474	$30,356,922
Bellbrook, City of	6,943	2,259	$5,089,527
Fairborn, City of	32,352	7,250	$16,334,425
Xenia, City of	25,719	6,400	$14,419,200
Bowersville, Village of	290	88	$198,264
Cedarville, Village of	4,019	346	$779,538
Clifton, Village of	104	34	$76,602
Jamestown, Village of	1,993	474	$1,067922
Spring Valley, Village of	479	154	$346,962
Yellow Spring, Village of	3,487	1,074	$2,419,722
Bath Township	8,241	1,033	$2,327,349
Beavercreek Township	5,762	1708	$3,848,124
Caesarscreek Township	1,137	392	$883,176
Cedarville Township	1,481	439	$989,067
Jefferson Township	942	281	$633,093
Miami Township	1,199	375	$844,875
New Jasper Township	2,568	882	$1,987,146
Ross Township	750	236	$531,708
Silvercreek Township	1,745	578	$1,302,234
Spring Valley Township	2,102	795	$1,791,135
Sugarcreek Township	8,039	2,334	$5,258,502
Xenia Township	6,537	1,708	$3,848,124

- Figure 7-1: Estimated Winter Storm Related Residential and Personal Property Losses

Building Exposure for Greene County – Severe Winter Storm

Building Type	Number of Structures	Estimated Loss
Residential	5,585	$ 116,862,252
Non-Residential	310	$ 61,989,918
Critical Facilities	10	$ 10,000,000
TOTAL	**5,905**	**$ 188,852,170**

Chapter 8 Summer Heat and Drought

Excessive heat occurs from a combination of high temperatures (significantly above normal) and high humidity. At certain levels, the human body cannot maintain proper internal temperatures and therefore may experience heat stroke. The "Heat Index" (HI) is a measure of the effect of these combined elements on the body.[13]

A daytime HI reaching 105°F or above with nighttime lows at or above 80°F for two consecutive days may significantly impact public safety and, therefore, generally requires the issuance of an advisory or warning by local national weather services offices.

Sudden rises in temperature, when people don't have a chance to acclimatize, or prolonged heat waves increase death rates. During 1979 to 1998 (the most recent years for which national data are available), 7,421 deaths in the United States were heat-related with a median of 274 deaths per year (range: 148-1700), and there was a median heat-related death rate of 0.1 per 100,000 population (range: 0.1-0.8). Heat-related death rates appear to be stable over time in all age groups with the highest mortality among persons over 65 years of age.[14]

Drought is generally a prolonged event involving drier-than-normal conditions and is a countywide hazard. Drought affects all jurisdictions and all areas of the country creating the possibility of excessive heat or periods of extreme cold that result in water-related problems. The amount of precipitation at a particular location varies from year to year but, over a period of years, the average amount is fairly constant.[15] Even if rainfall for a year is about average, rainfall shortages can occur during a period of excessive heat or when rainfall is crucial for plant and crop growth.

When there is little or no rainfall for short periods of time, soils can dry out and plants can die, but when rainfall is short for prolonged periods of time (several weeks, months, or years), water levels in wells, lakes reservoirs streams and rivers fall and flow declines. If dry conditions persist, water-supply problems develop and the dry period can become a drought.

13 www.crh.noaa.gov

14 Reported by: L Sathyavagiswaran, MD, Dept of the Coroner, Los Angeles County; JE Fielding, MD, D Dassy, MD, Los Angeles County Dept of Health Svcs. Health Studies Br, Div of Environmental Hazards and Health Effects, National Center for Environmental Health; and EIS officers, CDC.

15 U.S. Geological Survey Open File Report 93-642

The extent of the drought is determined by the Palmer Drought Index. The index depicts prolonged (in months or years) abnormal dryness or wetness; responds slowly; changes little from week to week; and reflects long-term moisture runoff, recharge, and deep percolation, as well as evapotranspiration.

Palmer Drought Severity Index	
< - 4.0	Extreme Drought
-3.99 to -3.0	Severe Drought
-2.99 to -2.0	Moderate Drought
-1.99 to -1.0	Mild Drought
-0.99 to -0.5	Incipient Drought
-0.49 to 0.49	Near Normal
0.50 to 0.99	Incipient Moist Spell
1.0 to 1.99	Moist Spell
2.0 to 2.99	Unusual Moist Spell
3.0 to 3.99	Very Moist Spell
> 4.0	Extreme Moist Spell

The following is a list of different definitions for drought provided by the National Drought Mitigation Center:

Meteorological drought: "A period of abnormally dry weather sufficiently prolonged for the lack of water to cause serious hydrologic imbalance in the affected area." (Huschke, R.E., ed., 1959, Glossary of meteorology: Boston, American Meteorological Society, 638 p.)

Agricultural drought: "A climatic excursion involving a shortage of precipitation sufficient to adversely affect crop production or range production." (Rosenberg, N.J., ed., 1979, Drought in the Great Plains — Research on impacts and strategies: Proceedings of the Workshop on Research in Great Plains Drought Management Strategies, University of Nebraska, Lincoln, March 26-28: Littleton, Colorado, Water Resources Publications, 225 p.)

Hydrologic drought: "A period of below average water content in streams, reservoirs, ground-water aquifers, lakes and soils." (Yevjevich Vujica, Hall, W.A., and Salas, J.D, eds., 1977, Drought research needs, in Proceedings of the Conference on Drought Research Needs, December 12-15, 1977: Colorado State University, Fort Collins, Colorado, 276 p.)

Some areas of the United States are more likely to have droughts than other areas. In humid, or wet regions, a drought of a few weeks is quickly reflected in a decrease in soil moisture and in declining flow in streams. People who use water from streams in these areas may face water shortages as soon as streamflow begins to decline. In arid, or dry regions, people rely on ground water and water in reservoirs to supply their needs. They are protected from short-term droughts, but may have severe problems during long dry periods because they may have no other water source if wells or reservoirs go dry.[20]

• Figure 8-1: U.S. Drought Vulnerability

[20] U.S. Geological Survey Open File Report 93-642

Hazard Identification

Excessive Heat

July 20-31, 1999 Excessive Heat

The last part of July was very hot and humid across the state with temperatures reaching into the 90s most days and above 100° for a few days. The dew points and overnight lows were in the 70s through much of the period. The excessive heat contributed to three (3) deaths in the Dayton metro area. Excessive heat contributed to substantial crop loss across much of Ohio.

June 13, 1994 Excessive Heat

Excessive heat caused $568,181.82 in crop loss.

September 1, 1983 Excessive Heat

Excessive heat caused $5,681.82 in crop loss.

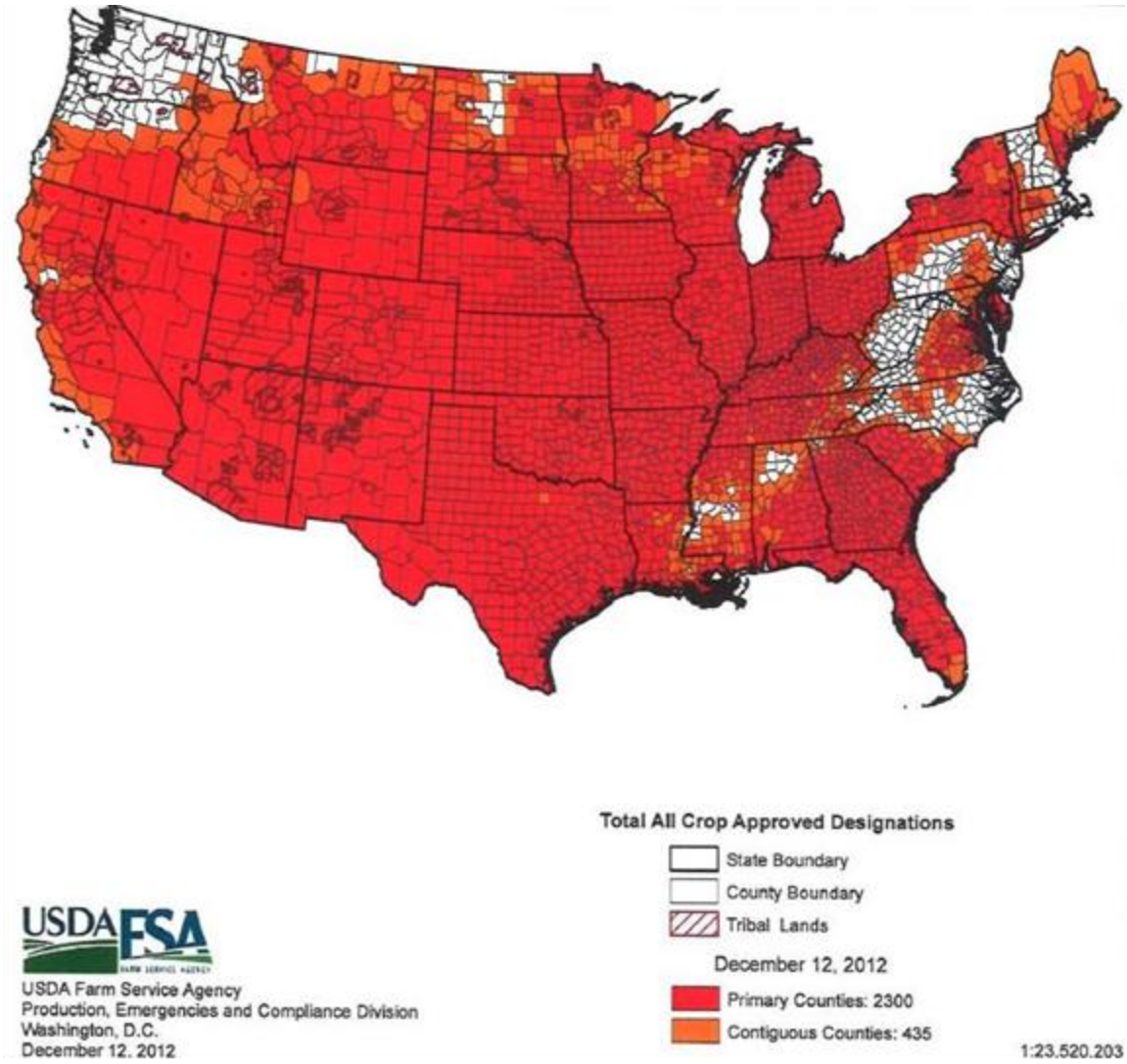
Drought Events

2012 Drought

2012 North American Drought

The 2012-2013 North American Drought is an expansion of the 2010-2012 United States drought which began in the spring of 2012, when the lack of snow in the United States caused very little melt water to absorb into the soil. The drought includes most of the US and included Ohio. Among many counties, Greene County was designated with moderate drought conditions by mid-June. It has been equaled to similar effects as droughts in the 1930's and 1950's but it has not yet been in place as long. However, the drought has inflicted, and is expected to continue to inflict, catastrophic economic ramifications. In most measures, the drought has exceeded the 1988-1989 North American Drought, which is the most recent comparable drought.

On July 30, 2012, the Governor of Ohio sent a memorandum to the USDA Ohio Stare Executive Director requesting primary county natural disaster designations for eligible counties due to agricultural losses caused by drought and additional disasters during the 2012 crop year. The USDA reviewed the Loss Assessment Reports and determined that there were sufficient production losses in 85 counties to warrant a Secretarial disaster designation. On September 5, 2012, Greene County was one of those designated counties. It is estimated, from statistics gathered from the USDA's Natural Agricultural Statistics Service, that the crop loss in 2012 was almost 300 percent greater than in 2011.



2002 Drought

Dry conditions that began in the spring and early summer continued through August with most areas receiving well below normal rainfall for the month. US Department of Agriculture Secretary Ann M. Veneman's designated 77 of Ohio's counties as part of a statewide disaster area due to agricultural losses caused by drought and other extreme weather meeting the criteria to be recommended for disaster designations, including Clark, Clermont, Clinton, Darke, Greene, Miami, Montgomery, Preble, and Warren. The USDA's damage assessments in August estimated that almost half the counties expected total crop losses of 30 to 50 percent, and 17 counties losses of 50 percent or more.[21]

COMMODITY LOSS STATISTICS
DROUGHT CONDITIONS

COUNTY: **Greene**

COMMODITY		Non-Drought Year 2011	Drought Year 2012	UNITS	CHANGE	AMOUNT
Corn - planted		58,000	63,800	acres	up	5,800
Corn, grain - harvested		57,800	61,900	acres	up	4,100
	Yield	99.66%	97.02%		down	2.63%
Corn, grain - production		10,173,000	9,014,000	bushels	down	1,159,000
Corn, grain - yield		176.0	145.6	bushels/acre	down	30.4
Hay - harvested		2,800	2,600	acres	down	200
Hay - production		8,600	6,600	tons	down	2,000
Hay - yield		3.05	2.55	tons/acre	down	0.50
Soybeans - planted		65,700	62,400	acres	down	3,300
Soybeans - harvested		65,600	62,400	acres	down	3,200
	Yield	99.85%	100.00%		up	0.15%
Soybeans - production		3,451,000	2,591,000	bushels	down	860,000
Soybeans - yield		52.6	41.5	bushels/acre	down	11.1
Wheat - planted		5,100	2,900	acres	down	2,200
Wheat - harvested		5,040	2,790	acres	down	2,250
	Yield	98.82%	96.21%		down	2.62%
Wheat - production		310,000	183,000	bushels	down	127,000
Wheat - yield		61.5	65.6	bushels/acre	up	4.1

Source: U.S. Dept. of Agriculture, National Agricultural Statistics Service

July 1- August 31, 1999 Drought
Dry conditions that began in the spring and early summer continued through August with most areas receiving well below normal rainfall for the month. Rainfall was widely scattered and did little to help farmers. Most counties in southwest Ohio were declared Federal Disaster Areas by the US Department of Agriculture.

1988 Drought
Statewide drought, short but severe. Rapid declines in stream flow, ground-water levels, and reservoir levels. Mandatory water-use restrictions instituted in many municipalities.

1959-1968 Drought
Statewide drought. More severe in the east-central and northwestern Ohio.

1952-1957 Drought
More severe in southwestern Ohio the balance of the state.

1939-1946 Drought
Statewide serious water shortages.

1930-1936 Drought
Regional and statewide drought with serious water shortages and of gross farm income estimated at $639 million in 1930.

Hazard Probability

All jurisdictions within Greene County are vulnerable to excessive heat and drought. Greene County has experienced, over the past 84 years, 17 excessive heat or drought events that have caused significant damages. Based on the number of events identified and using the simplest formula possible, the number of events divided by the number of recorded years, there is a 20 percent chance that an event could occur somewhere in Greene County annually.

A list is presented of the driest 12-month periods in Ohio, 1854-1992, as measured using monthly precipitation data. The precipitation amount is the 12-month sum of the monthly statewide precipitation average obtained using all available cooperative weather stations. The list presents the lowest 12-month averaged value occurring during a period when several adjacent 12-month periods may have also had less than 29 inches of precipitation (approximately two standard deviations below normal). The list continues with amounts above 29 inches until the 1991-1992 drought, shown for comparative purposes.

[21] http://www.state.oh.us/gov/releases/082302usda.htm

Time Period: Precipitation Total[22]

. April 1930 - March 1931: 21.93 inches
. November 1894 - October 1895: 25.56 inches
. January - December 1963: 26.50 inches
. January - December 1934: 26.69 inches
. February 1953 - January 1954: 27.44 inches
. February 1856 - January 1857: 27.81 inches
. September 1987- August 1988: 28.33 inches
. May 1874 - April 1875: 28.44 inches
. April 1863 - March 1864: 28.49 inches
. February 1960 - January 1961: 28.53 inches
. April 1871 - March 1872: 28.60 inches
. December 1900 - November 1901: 28.60 inches
. July 1924 - June 1925: 28.66 inches
. June 1940 - May 1941: 28.74 inches
. May 1904 - April 1905: 29.33 inches
. August 1943 - July 1944: 29.58 inches
. May 1991 - April 1992: 29.97 inches

Vulnerability Analysis

Drought and extreme heat conditions usually do not affect structures, however, it has drastic effects on humans, animals and crops.

[22] http://thoth.sbs.ohio-state.edu/faculty/rogers/drought.html

Chapter 9 Earthquake

An earthquake is a sudden, rapid shaking of the Earth caused by the breaking and shifting of rock beneath the Earth's surface. For hundreds of millions of years, the forces of plate tectonics have shaped the Earth as the huge plates that form the Earth's surface move slowly over, under, and past each other. Sometimes the movement is gradual. At other times, the plates are locked together, unable to release the accumulating energy. When the accumulated energy grows strong enough, the plates break free causing the ground to shake. Most earthquakes occur at the boundaries where the plates meet; however, some earthquakes occur in the middle of plates.[23]

Earthquakes are one of the most dangerous and damaging hazards and strike without warning. In any given year, there are approximately 500,000 detectable worldwide and 100,000 of those can be felt, and one percent of them cause damage.

Charles F. Richter developed the Richter magnitude scale in 1935 to measure and compare the magnitude of earthquakes, but this method is not used to express damage. The magnitude is determined from measurements recorded by seismographs. The following is a chart illustrating the various ranges and the associated levels and severity of damage.

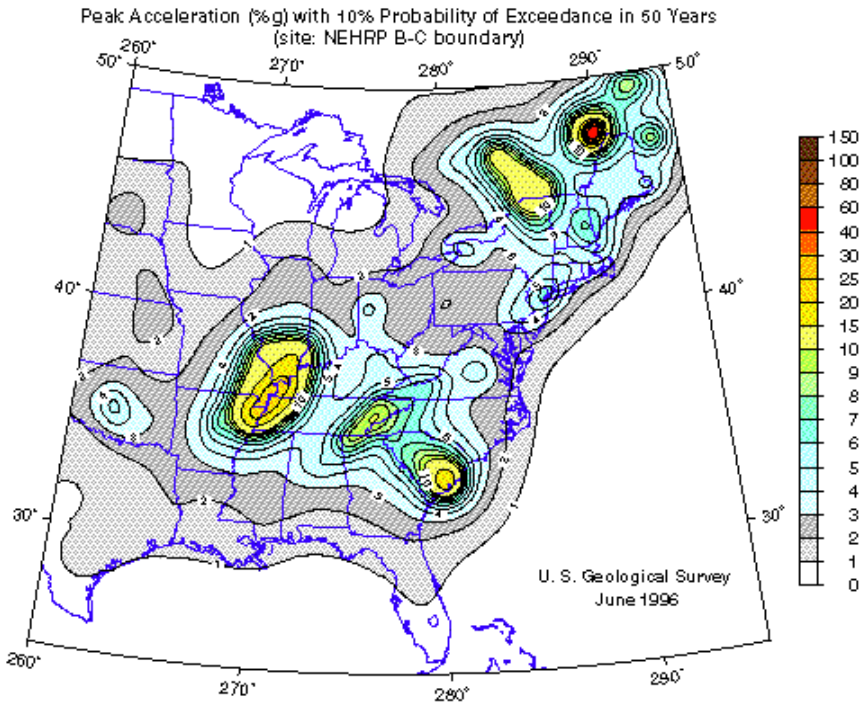
[23] http://www.fema.gov/hazards/earthquakes/quake.shtm

Scale		
Magnitude	Mercalli	Description
0-2.9	I	Detected only by sensitive instruments
	II	Felt only by a few persons at rest, especially on upper floors of buildings; delicately suspended objects may swing
	III	Felt noticeably indoors, especially on upper floors of buildings, but not always recognized as earthquake; standing autos may rock slightly; vibrations like a passing truck
2.9-4.1	IV	During the day, felt indoors by many, outdoors by few; at night, some awakened; dishes, windows, doors disturbed; walls make creaking sound; sensation like heavy truck hitting building; standing autos rock noticeably
	V	Felt by most people; some breakage of dishes, windows, and plaster; unstable objects overturned; disturbance of trees, poles, and other tall objects
4.1-5.4	VI	Felt by all, many frightened and run outdoors; some heavy furniture may move; falling plaster and chimneys, damage slight
	VII	Everyone runs outdoors; damage to buildings varies depending on quality of construction; noticed by people driving autos
5.4-7.3	VIII	Panel walls thrown out of frames; walls, monuments, chimneys fall; sand and mud ejected; drivers of autos disturbed
	IX	Buildings shifted off foundations, frame structures thrown out of plumb; ground cracked; underground pipes broken
	X	Most masonry and frame structures destroyed; ground badly cracked, rails bent, landslides; sand and mud shift; water splashes over river banks
7.3+	XI	Few structures remain standing; bridges destroyed; broad fissures in ground, pipes broken, landslides, rails bent
	XII	Damage total; waves seen on ground surface, lines of sight and level distorted, objects thrown up into the air

Source: http://www.dnr.state.oh.us/OhioSeis/html/scales.htm
• Figure 9-1: Seismic Magnitude/Intensity Scales

There are 45 states and territories in the United States at moderate to very high risk from Earthquakes (areas with peak acceleration[24] greater than 2%g), and they are located in every region of the country. California experiences the most frequent damaging earthquakes; however, Alaska experiences the greatest number of large earthquakes—most located in uninhabited areas. The largest earthquakes felt in the United States were along the New Madrid Fault in Missouri, where a three-month long series of quakes from 1811 to 1812 included three quakes larger than a magnitude of 8 on the Richter Scale. These earthquakes were felt over the entire Eastern United States, with Missouri, Tennessee, Kentucky, Indiana, Illinois, Ohio, Alabama, Arkansas, and Mississippi experiencing the strongest ground shaking.[25]

[24] The peak acceleration is the largest acceleration recorded by a particular station during an earthquake. http://geohazards.cr.usgs.gov/eq/html/info.html
[25] http://www.fema.gov/hazards/earthquakes/quake.shtm



• Figure 9-2: Peak Acceleration (%g) with 10% Probability of Exceedance in 50 Years, Central and Eastern US Hazard Maps, 1996
Source: http://geohazards.cr.usgs.gov/eq/html/ceusmap.html

Although most people do not think of Ohio as an earthquake-prone state, at least 120 earthquakes with epicenters in Ohio have been felt since 1776. In addition, a number of earthquakes with origins outside Ohio have been felt in the state. Most of these earthquakes have been felt only locally and have caused no damage or injuries. However, at least 14 moderate-size earthquakes have caused minor to moderate damage in Ohio. Fortunately, no deaths and only minor injuries have been recorded for these events.

Ohio is the periphery of the New Madrid Seismic Zone, an area in Missouri and adjacent states that was the site of the largest earthquake sequence to occur in historical times in the continental United States. Four great earthquakes were part of a series at New Madrid in 1811 and 1812. These events were felt throughout the eastern United States and were of sufficient intensity to topple chimneys in Cincinnati. Some estimates suggest that these earthquakes were in the range of 8.0 on the Richter scale.

A major earthquake centered near Charleston, South Carolina, in 1886 was strongly felt in Ohio. More recently, an earthquake with a Richter magnitude of 5.3 centered at Sharpsburg, Kentucky, 1980 was strongly felt throughout Ohio and caused minor to moderate damage in communities near the Ohio River in southwestern Ohio. In 1998 a 5.2-magnitude earthquake occurred in western Pennsylvania, just east of Ohio, and caused some damage in the epicentral area.

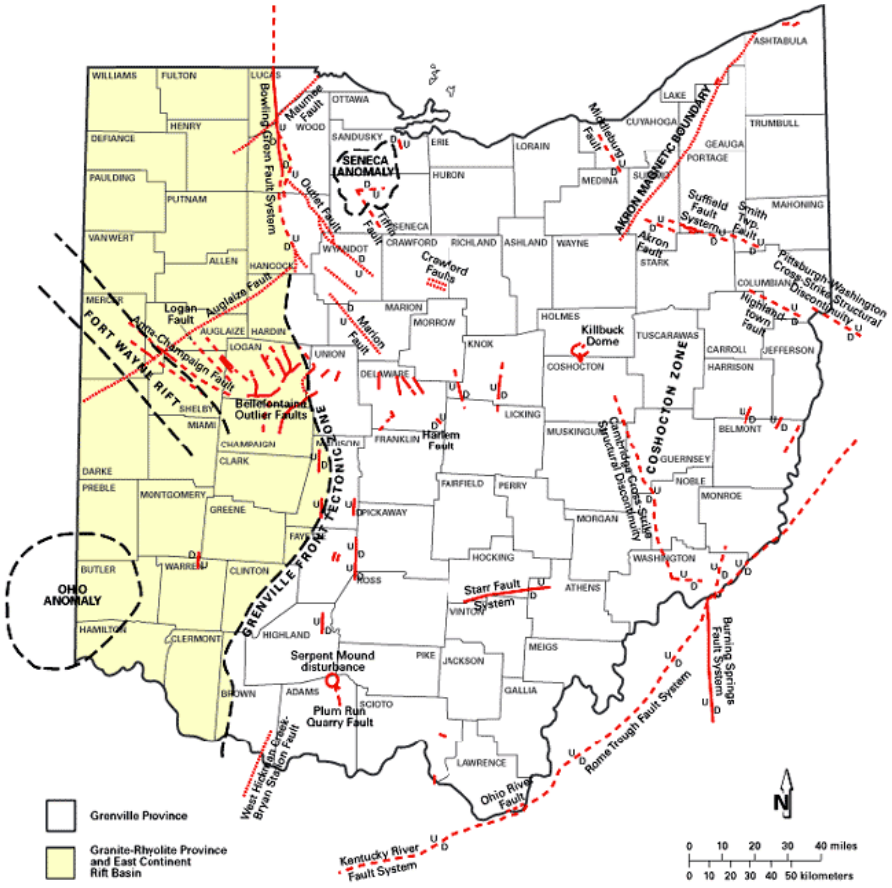
EARTHQUAKE REGIONS

Three areas of the state appear to be particularly susceptible to seismic activity: the northeastern, northwestern, and southwestern areas of the state (See Figure 9-3).

Source: Ohio Department of Natural Resources, OhioSeis
• Figure 9-3: Earthuake Epicenters in Ohio and Border Areas

Southeastern Ohio has been the site of at least 10 felt earthquakes with epicenters in the state since 1776. The 1776 event, recorded by a Moravian missionary, has a very uncertain location. Earthquakes in 1901 near Portsmouth (Scioto County), in 1926 near Pomeroy (Meigs County), and in 1952 near Crooksville (Perry County) caused minor to moderate damage.

CAUSES OF OHIO EARTHQUAKES

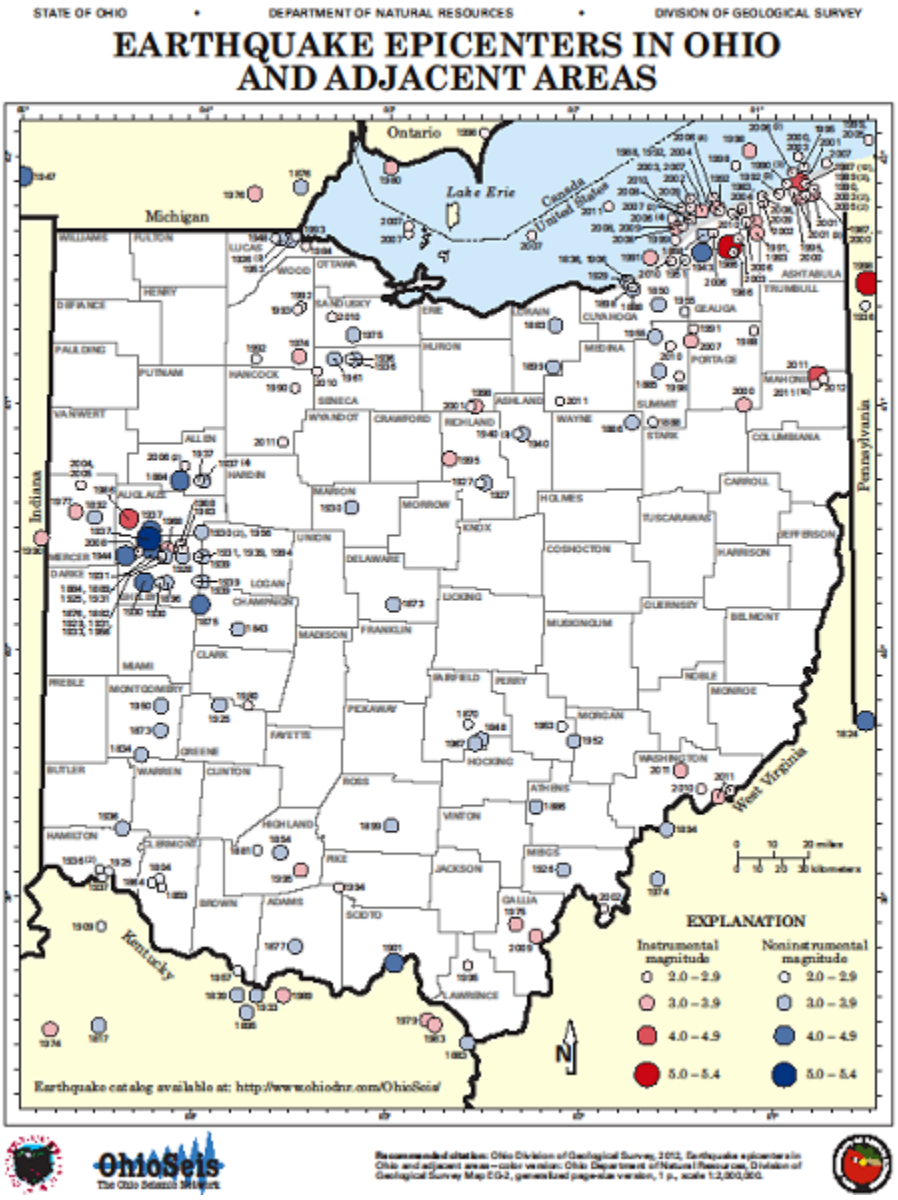


Source: Ohio Department of Natural Resources, OhioSeis

• Figure 9-4: Map of Deep Structures in Ohio

[26] http://www.dnr.state.oh.us/OhioSeis/html/geo_f03.htm

History of Earthquake in Greene County



Source: www.ohiodnr.com/OhioSeis

• Figure 9-5: Historical Earthquakes in Ohio

Social and geological records indicate that Greene County has little seismic history adversely affecting the economics or population of the county.

The most recent earthquake to be felt in the Greene County area was August 23, 2011, an earthquake, apparently centered in Virginia, was felt across parts of Ohio, including Greene County.

January 31, 1986. An earthquake, with an epicenter originating in the Lake/Geauga County region and registered 4.2 on the Richter Scale, was felt in Greene County.

On October 4, 1980 at 11:46 a.m. the county was shaken by an earthquake. The epicenter of the earthquake was actually in Clark County, near the Greene County border and the magnitude of the quake was 2.0. Tremors could be felt in Greene County and the impacts were not severe. The county experienced no property or economic losses as a result of the quake.

On July 27, 1980 shaking could be felt in the Greene County area as a result of an earthquake that originated in the Sharpsburg, Kentucky area. No damage was reported as a result of this quake.

April 3, 1974, just hours after the tornado in Xenia, Greene County experienced tremors from an earthquake in Mattoon, Illinois. On November 19, 1969 an earthquake centered in Virginia registered 4.75 on the Richter scale and could be felt in the Greene County Area.

Two of the largest quakes in Ohio, which centered in Anna could be felt in Greene County on March 2 and 9, 1937 and prior to that a major earthquake in Charleston, South Carolina in 1886.

As mentioned previously, four great earthquakes were part of a series at New Madrid in 1811 and 1812. The earthquakes registered 8.0 on the Richter Scale and were felt through the eastern United States and Greene County was no exception.

All jurisdictions within Greene County are vulnerable to earthquakes. Greene County has experienced, over the past 204 years, 11 events have been recorded as significant. Based on the number of events identified and using the simplest formula possible, the number of events divided by the number of recorded years, there is a 5 percent chance that an event could occur somewhere in Greene County annually.

Seismic Risk[27]

Seismic risk in Ohio, and the eastern United States in general, is difficult to evaluate because earthquakes are generally infrequent in comparison to plate-margin areas such as California. Also, active faults do not reach the surface in Ohio and therefore cannot be mapped without the aid of expensive subsurface techniques.

A great difficulty in predicting large earthquakes in the eastern United States is that the recurrence interval--the time between large earthquakes—is commonly very long, on the order of hundreds or even thousands of years. As the historic record in most areas, including Ohio, is only on the order of about 200 years—an instant, geologically speaking—it is nearly impossible to estimate either the maximum magnitude or the frequency of earthquakes at any particular site.

Earthquake risk in the eastern United States is further compounded by the fact that seismic waves tend to travel for very long distances. The relatively brittle and flat-lying sedimentary rocks of this region tend to carry these waves throughout an area of thousands of square miles for even a moderate-size earthquake. Damaging ground motion would occur in an area about 10 times larger than for a California earthquake of comparable intensity.

An additional factor in earthquake risk is the nature of the geologic materials upon which a structure is built. Ground motion from seismic waves tends to be magnified by unconsolidated sediments such as thick deposits of clay or sand and gravel. Such deposits are extensive in Ohio. Buildings constructed on bedrock tend to experience much less ground motion, and therefore less damage. Geologic maps, such as those prepared by the Ohio Division of Geological Survey, delineate and characterize these deposits. Geologic mapping programs in the state geological surveys and the U.S. Geological Survey are therefore critical to public health and safety.

The brief historic record of Ohio Earthquakes suggests a risk of moderately damaging earthquakes in the western, northeastern, and southeastern parts of the state. Whether these areas might produce larger, more damaging earthquakes is currently unknown, but detailed geologic mapping, subsurface investigations, and seismic monitoring will greatly help in assessing the risk. Earthquakes vary in intensity. Some can only be detected with special equipment; others can destroy entire suspension bridges, city blocks, and lives.

[27] http://www.dnr.state.oh.us/OhioSeis/html/geo_f03.htm

At this time it is almost impossible to determine to what extent an earthquake may actually affect the County. If recent events were repeated today, the entire county would likely feel the effects of the quake, but would sustain very little damage to personal property and public infrastructure. Dishes, unsecured collectibles, and picture frames may be disturbed or broken. Windows and doors may also be disturbed.

Vulnerability Assessment

Methodology. Hazards US – Multi Hazard (HAZUS-MH) version Maintenance Release 4 (MR4) built on an ArcGIS 9.3.1 platform with ArcView license was used to project a vulnerability assessment for a plausible earthquake scenario that could occur in Greene County. The scenario was selected from Ohio SEIS maps demonstrating that the strongest quake experienced to date is a 5.4 magnitude wave. A depth of zero kilometers was selected as the epicenter would cause the most damage, therefore creating a worst-case scenario for planning purposes. The results are displayed from the HAZUS run in a format that is ready for input to Ohio EMA's State Hazard Analysis and Resource Planning Portal (SHARPP):

Building Exposure for Greene County – Earthquake (5.4 Mw @ 0 km depth)

Building Type	Number of Structures	Estimated Loss
Residential	5,732	$ 1,136,237,101.89
Non-Residential	1,793	$ 369,292,266.54
Critical Facilities	102	$ 21,008,260.56
TOTAL	**7,627**	**$ 1,526,537,629.00**

Chapter
10 Other Events

Greene County has been susceptible to a multitude of natural disasters throughout its history. Many of these disasters have resulted in Disaster Relief Funds to be granted. In addition to the natural disasters there have been events that do not fall within the categories addressed in this document but have also resulted in Disaster Relief Funds being granted. Hurricanes are not considered in most disaster response plans within Ohio but events in the past have caused that thinking to be reconsidered.

September 2008 HURRICANE

The remnants of Hurricane Ike made its way across Ohio packing winds at speeds equal to a Category 1 hurricane. Strong winds moved diagonally across the state from southwest to northeast over a four-hour period. Losses compiled by insurance companies and state government mounted over time, capping Ohio's largest natural disaster in recent history - the Xenia Tornado of 1974. Strong winds of 40 to 50 miles per hour were sustained for several hours. The Dayton International Airport measured a gust to 69 mph while a 60 mph gust was recorded in Vandalia. Widespread damage occurred across the region including trees falling on power lines, significant crop losses and structural damage at an estimated $63.7 million.

According to Property Claim Services, Ohio's insured losses from Hurricane Ike were approximately $1.255 billion. State and Federal agencies quoted local government costs for protection and clean up at an additional $38.6 million. According to the Ohio Insurance Institute, total damages from the Xenia Super-outbreak are about $1 billion in 2008 dollars. Greene County was granted $2,256,594.13 in public assistance funds for this event **(DR-1805).**

September 2005 HURRICANE

Hurricane Katrina, which struck the gulf coast in August 2005, has had lasting and far-reaching effects. Katrina caused massive flooding in the city of New Orleans and catastrophic damage along the gulf coasts of Alabama, Mississippi, and Louisiana. As a result, Katrina caused one of the largest relocations of people in U.S. history.

Chapter 11

Goals and Action Items

Greene County Pre-Mitigation Plan

The mission of the Greene County Natural Emergency Mitigation Planning Team is *to create a comprehensive research-based hazard mitigation plan to reduce the risk, damage to life and property, and public cost to Greene County communities, agencies, businesses and natural resources caused from the effects of natural hazards like earthquake, wind, rain, flood, hail, snow and heat.*

Introduction

This Chapter provides information on the process used to develop the goals and action items pertaining to the natural hazards identified in the previous chapters.

As the planning group met certain issues and trends emerged from the natural hazard data reviewed in Chapters Three through Nine and the Inventory of Existing Conditions in Chapter Two. This chapter provides information on the process used to develop and set the priorities, summarizes the information from the preceding seven chapters and presents how these issues and trends determined the development of priorities, strategies and outcomes.

Although the properties have remained the same since the last FEMA approved plan, the Greene County Natural Emergency Mitigation Planning Team reviewed and analyzed all parts of the plan. The team determined the properties and goals were determined to be current and valid.

In general, four priorities emerged: educating the public; protecting life and property; developing/enhancing existing partnerships for mitigation and response activities; and creating a safer environment through construction or installation projects of natural hazard safety systems. The mitigation strategy, goals, objectives and actions were also prioritized with economic considerations in mind.

Most of our focus was on priority one, educating the public and can be applied to all of the hazards identified during the analysis stage. The projects developed reach citizens countywide and affect the entire population.

The second priority consists of very different types of activities which reduce or limit the risk faced by the public as a result of natural disaster. One activity pertains to plans and codes and another pertains to construction or installation projects and requires a significant investment to launch and

generally affect only a limited group of the population.

The third priority deals with the development and enhancement of existing partnerships for mitigation and response activities. This priority was addressed by the formation of the Mitigation Planning Team and the outreach to the local jurisdictions, partnering organizations, and the public. A fourth priority was created for the longer term construction projects. In order to create a safer environment, several construction or installation projects, based on natural hazard safety systems, were submitted by the local jurisdictions.

Identifying the Problem(s)

In the first stage of the plan's development, the Pre-Mitigation Planning Team (PMPT) reviewed the data provided in the Hazard Assessment/Analysis and examined the problems caused by natural hazards in the county. The purpose of this analysis is to determine priorities for mitigation spending. The group focused their attentions to those events, which frequently trouble the area. Based on the information provided, the following hazards were summarized for Greene County and were presented only for the impact of the specified natural disaster and not potential mitigation plans.

Tornadoes and High Winds – Greene County is known for its vulnerability to tornadoes and the damages they cause. There have been 14 tornadoes in the county over the past 40 years, or an average of approximately one tornado every three years. Most of the tornadoes did not cause injuries or death, and the majority of injuries and deaths were recorded in two events. Over 40 years, Greene County averaged one death, 32 injuries, and $6.7 million damages per year from tornadoes.

Winter Storms – Although some years pass without winter storms, on average there are several occurrences per year. Unlike tornadoes and floods, winter storms typically impact every part of the county. In a heavily urbanized county like Greene County, this translates into hundreds of thousands of people, thousands of miles of streets and roads, dozens of schools and hundreds of businesses that are impacted. The data suggests that on average there is approximately one death and three injuries per year from winter storms, but these numbers probably do not reflect traffic accidents. The statistics also do not include heart attacks, which are often directly caused by heavy snowfall and attempts to shovel it. Winter storms often require a significant investment for local governments: snow removal, traffic control, EMS runs for accident and heart attack victims, water line breaks, etc. However, because of their frequency, most jurisdictions plan for the effects of winter storms.

Floods – Localized flooding will likely occur somewhere in the county every year. Flooding is likely to occur in densely developed areas as a result of rapid rainfall over a very short period of time causing urban runoff. Flooding generally occurs in low-lying areas along rivers and tributaries, and often will occur along several unconnected waterways simultaneously. Flooding can cause death and injury but the likelihood is low if commonly recognized precautions are taken. Local zoning and building authorities as well as the real estate, banking and insurance industries exert significant effort in managing development in floodplain areas, but flood losses continue to rise every year.

Severe Heat and Drought Events – This category has the smallest amount of available data but can cause devastating impacts, particularly on agriculture and water supply. Like winter storms, some years pass without incident, but severe heat and drought impacts the entire county also translating into the possibility of hundreds of thousands of people affected. National data suggests that on average there is approximately 0.1-0.8 deaths per 100,000 population per year caused by summer heat. In Greene County, this means we can expect one to two deaths annually directly caused by summer heat. It seems reasonable to expect severe heat and drought events at least every 10 to 15 years, if not more often.

Hail Storms – Hailstorms, like floods, can be expected to occur every year. Most cause little damage, but the data suggest that the risk of injuries and deaths is very low but there will be some property damage from hail storms. Most of the hailstorms average approximately $12,000 in damages per year, but the April 2001 event reportedly caused $73 million in insured damages in Montgomery County which borders Greene County.

Earthquakes – Earthquakes can be felt and even cause damages for hundreds of miles. Greene County residents have felt eight earthquakes during the past 117 years but none of them actually occurred in the county. There were no reported damages from any of the earthquakes. Over the past 117 years earthquakes have been felt on an average of once per 15 years. A closer look at the data reveals that they actually occur less often but when they do occur there can be two or more tremors in a short sequence, separated by only a few weeks. This was the case in 1980 and 1937, and historic records indicate four earthquakes in 1811 and 1812.

Determining the "as-is" condition of the county was a multi-stage process. This process included identifying how many of the participating jurisdictions had an Emergency Mitigation Plan, Emergency Response Plan, Storm Water Management Plan, Floodplain Management Plan, Storm Drainage Improvement Plan, Soil Management Plan, Erosion Control Plan, and Building Codes. Once that information was compiled a determination could be made on which areas to focus mitigation efforts. (Refer to the following table)

Jurisdictional Plans and Programs								
Jurisdiction	Emergency Mitigation Plan	Emergency Response Plan	Storm Water Management Plan	Development within Floodplain	Storm Drain Improvement Plan	Soil Management	Erosion Control	Building Codes
Bath Township		X		X				
Beavercreek		X	X	X	X			
Beavercreek Township		X	(wetlands)	X			X	
Bellbrook		X	X	X	X			
Bowersville		X						
Caesars Creek Township		X		X				
Cedarville		X						
Cedarville Township		X		X				
Clifton		X						
Fairborn		X	X					
Greene County		X		X				X
Jamestown		X						
Jefferson Township		X		X				
Miami Township		X		X				
New Jasper Township		X	X	X				
Ross Township		X		X				
Silvercreek Township		X		X				
Spring Valley			X	X				
Spring Valley Township		X		X				
Sugarcreek Township		X		X				
Wilberforce CDP								
Xenia Township		X		X				
Yellow Springs								

• Figure 12-1: Plans Reviewed

The Emergency Response Plan and County Comprehensive Plan were used to develop and update the hazard identification and risk assessment. The hazard identification, risk and vulnerability assessments for flooding incorporated hydrologic and hydraulic information from floodplain maps, Flood Insurance Study, floodplain regulations, Storm Water Management Plan,

Zoning Ordinances, Erosion Control Plan and Storm Drain Improvement Plan.

COMMUNITY	PLANNING COMMISSION	COMPREHENSIVE PLANS	FLOODPLAIN REGULATIONS	BUILDING CODES[1]	ZONING ORDINANCES	CAPITAL BUDGET[2]	PUBLIC WORKS BUDGET[2]
Greene County	YES	YES	YES	YES	YES / NO	(none)	Limited in-kind wages only.
City of Beavercreek	YES / NO	YES / NO	YES / NO	YES	YES / NO	(none)	Limited in-kind wages only.
City of Belbrook	YES / NO	YES / NO	YES / NO	YES	YES / NO	(none)	Limited in-kind wages only.
City of Fairborn	YES / NO	YES / NO	YES / NO	YES	YES / NO	(none)	Limited in-kind wages only.
City of Xenia	YES / NO	YES / NO	YES / NO	YES	YES / NO	(none)	Limited in-kind wages only.
Village of Bowersville	YES / NO	YES / NO	YES / NO	YES	YES / NO	(none)	Limited in-kind wages only.
Village of Cedarville	YES / NO	YES / NO	YES / NO	YES	YES / NO	(none)	Limited in-kind wages only.
Village of Clifton	YES / NO	YES / NO	YES / NO	YES	YES / NO	(none)	Limited in-kind wages only.
Village of Jamestown	YES / NO	YES / NO	YES / NO	YES	YES / NO	(none)	Limited in-kind wages only.
Village of Spring Valley	YES / NO	YES / NO	YES / NO	YES	YES / NO	(none)	Limited in-kind wages only.
Village of Yellow Springs	YES / NO	YES / NO	YES / NO	YES	YES / NO	(none)	Limited in-kind wages only.

[1] All jurisdictions within the state now follow the State Building Code. (Ohio Administrative Code 4101:1.)

[2] Budget that would allow the jurisdiction to devote financial resources towards hazard mitigation activities.

The Planning Team then determined the "as-is" state of the county or the vulnerability that existing hazards present. As a result, the hazard events were ranked not only by frequency, but the group also considered factors such as number of deaths, injuries, and total dollar loss for each event type (Refer to the following table).

HAZARD RANKING				
	FREQUENCY	IMPACT	INJURY/DEATH	OVERALL RANK
TORNADO & WIND	1	2	2	1
SEVERE WINTER	4	1	1	2
FLOOD	3	4	3	3
SEVERE SUMMER	5	3	4	4
HAIL	2	6	5	5
EARTH QUAKE	6	5	6	6

• Figure 12-2: Hazard Ranking

Select the Best Activities and Develop Action Plans

The Pre Mitigation Planning Team identified the plan goals, which would most effectively minimize or eliminate problems caused by natural hazards in the county by working through a multi-stage process over a period of several weeks.

To complete this process, the PMPT first brainstormed to identify the goals, objectives, and identified problem areas concerned with each hazard. To develop the best solution the PMPT found it important to consider many possible solutions. All of the solutions were recorded and evaluated during the brainstorming session.

The procedure for the brainstorming sessions is as follows:

- A facilitator and a recorder were selected
- The problem(s) or idea(s) to be brainstormed were well defined
- The facilitator encouraged members of the group to share their thoughts. These were recorded so everyone could see the remarks and compiled after each meeting.

Once brainstorming had finished, the results were evaluated for:

- Repeated or very similar statements
- Similar concepts, e.g. building code revision or enhancement
- Improbability - these were consequently removed.

The resulting goals set by the PMPT are listed by priority and apply to all natural hazards.

Goal One: Increase Public Awareness

Develop and implement educational programs to increase the community's awareness of the risks associated with natural hazards affecting the County and provide information on weather-related - preparedness tools and resources

Goal Two: Protect Life and Property

Encourage the government, the public, builders and other construction industry workers to utilize construction methods, which protect lives by making new and existing structures safer or resistant to damage typically caused by natural hazards, improve hazard assessment information, and encourage the government, the public, and businesses to create and maintain a sense of safety from natural hazards

Goal Three: Create and/or strengthen Partnerships

Create a County Hazard Mitigation Committee/Team to develop a strategy for coordination and participation by public entities, the business community, non-profit organizations, and residents of the county to develop sustainable mitigation activities

Goal Four: Create a safer environment through construction or installation projects of natural hazard safety systems

Install or construct structures and systems, which protect lives by making new and existing structures and areas safer or resistant to damage typically caused by natural hazards

Identify Potential Projects

To identify potential projects the Pre Mitigation Planning Team worked through an additional three-week multi-stage process in which the Team brainstormed a list of potential projects based on the itemized goal and problem list developed in the previous sessions. Most of the projects identified could feasibly be applied to all hazards.

Once the Pre Mitigation Planning Team identified all of the possible activities that could reduce hazard damage in Greene County, the Team identified the criteria to evaluate each set of activities. The criteria considered were:

- Cost effectiveness
- Feasibility
- Social impact (How well the activity addresses the problem and reduces the risk)

First, the group looked at public information and education programs because the largest audience could effectively be reached for the smallest amount of initial funding. This process can be achieved relatively inexpensively and quickly through the reproduction and distribution of materials in the public libraries, at community events, on the public access Internet and television sites. These activities will increase public awareness to their vulnerability and property risk and will increase public awareness of possible preventative steps each can employ to reduce personal risk.

Second, the team focused on preventative activities, which are considered both short and long term projects, for example encouraging jurisdictions to enforce or enhance building, zoning, and planning codes and/or code enforcement.

An additional tool considered is new or ongoing natural resource protection/planning. Several communities in the Greene County area utilize wetland planning/restoration as a natural solution to storm water runoff and should be encouraged to mentor other communities in successful wetland/natural resource planning.

Another preventative approach considered by the PMPT was the installation of tornado siren systems or tornado safe rooms/shelters. These are long-term actions and very costly to install, not to mention involve ongoing maintenance costs. As a result, tornado sirens and tornado safe room construction were moved to a lower priority on the project lists. Because repetitive loss properties were not identified in the hazard assessment, a building-by-building or parcel basis construction action plan was not a consideration.

In addition, the PMPT considered requesting snow level emergencies to protect Greene County citizens during hazardous winter storms, but the Greene County Sheriff does not initiate snow level emergencies because of opposition from the business community. This activity was also removed from the potential project list.

As a result the following list of goals, strategies, and action items was developed.

Please note that each project identified below applies to both the county and the jurisdictions. For example, if the county identified Public Awareness as a goal then the goal applies to every jurisdiction within the county and any present or future projects.

Goal One: Increase Public Awareness

Situational Analysis: Floods, earthquakes, tornadoes and high winds, thunderstorms, snowstorms, droughts, and temperature extremes — every resident, employee, and business face the possibility of experiencing them all. These events can damage and even incapacitate a community for an extended period of time. Knowing the likelihood of a disaster is the best protection from a disaster. Learning to live with the natural forces, which surround us, minimizes the negative impact from natural disasters.

Objective: Educate the public to protect the public

Strategy #1: *Increase the community's awareness of the risks associated with natural hazards affecting the County and provide information on weather-related-preparedness tools and resources by developing and implementing educational programs*

Action Items:

Action 1.1.1 Develop and distribute information about risks associated with the identified natural disasters affecting the County.

2015 Status: Ongoing
Project Lead: Greene County EMA Director
Start Date: March 1, 2015
End Date: March 1, 2020
Funding Source: EMPG, Local Funds
Action Type: Public Education

Action 1.1.2 Develop and distribute an informational brochure on the types of homeowners hazard insurance, i.e. flood, fire, earthquake, etc.

2015 Status: Unchanged
Project Lead: Greene County EMA Director
Start Date: March 1, 2015
End Date: March 1, 2020
Funding Source: EMPG, Local Funds
Action Type: Public Education

Action 1.1.3 Launch educational campaigns through public/government cable channels and newsletters, websites, street festivals, libraries, school functions, etc.

2015 Status: Ongoing
Project Lead: Greene County EMA Director
Start Date: March 1, 2015
End Date: March 1, 2020
Funding Source: EMPG, Local Funds
Action Type: Public Education

Strategy #2: *Improve hazard assessment information*

Action Items:

Action 1.2.1 Develop and distribute information/education on weather-related-preparedness tools and resources, i.e. sources to purchase such material, etc.

2015 Status: Ongoing
Project Lead: Greene County EMA Director
Start Date: March 1, 2015
End Date: March 1, 2020
Funding Source: EMPG, Local Funds
Action Type: Public Education

Action 1.2.2 Develop and launch awareness/educational campaigns to increase knowledge of weather alert methods (alert radios, e-mail, cell phones, etc.

2015 Status: Ongoing
Project Lead: Greene County EMA Director
Start Date: March 1, 2015
End Date: March 1, 2020
Funding Source: EMPG, Local Funds
Action Type: Public Education

The county has Hyper Reach and continues to promote the use.

Action 1.2.3 Educate the public on the importance of properly trimming and maintaining the trees on their property (may be included in materials about natural hazard risk)

2015 Status: Ongoing
Project Lead: Greene County EMA Director

Start Date: March 1, 2015
End Date: March 1, 2020
Funding Source: EMPG, Local Funds
Action Type: Public Education

Action 1.2.4 Educate the public, businesses and residents, of the importance of creating hazard contingency plans (May be included in materials about natural hazard risk)

2015 Status: Ongoing
Project Lead: Greene County EMA Director
Start Date: March 1, 2015
End Date: March 1, 2020
Funding Source: EMPG, Local Funds
Action Type: Public Education

Action 1.2.5 Develop and complete a baseline survey to gather citizens' perceptions of the risks associated with natural disasters and the tools and services available to the public to reduce risk

2015 Status: Ongoing
Project Lead: Greene County EMA Director
Start Date: March 1, 2015
End Date: March 1, 2020
Funding Source: EMPG, Local Funds
Action Type: Public Education

Action 1.2.6 Develop and complete a periodic post-educational campaign surveys to gather citizens' perceptions of the risks associated with natural disasters and the tools and services available to the public to reduce risk (Method to measure the effectiveness of educational campaigns)

2015 Status: Ongoing
Project Lead: Greene County EMA Director, Local Jurisdictions Mayors/Managers/Trustees and Mitigation Planning Team
Start Date: March 1, 2015
End Date: March 1, 2020
Funding Source: EMPG, Local Funds
Action Type: Public Education

Make the County Natural Hazard Mitigation Plan available to the public by publishing the plan on public website(s). The Plan was posted on the Greene County Emergency Management Agency

Website. The Plan is continually being revised.

Goal Two: Protect Life and Property

Situational Analysis: Losses endured because of natural disaster continues to rise every year.

Objective: Build safer communities

Strategy #1: *Encourage the government, the public, builders and other construction industry workers to utilize construction methods which protect lives by making new and existing structures safer or resistant to damage typically caused by natural hazards*

Action Items:

Action 2.1.1 Encourage the use of wind and impact resistant building components designed to withstand tornado strength winds.

2015 Status: Ongoing
Project Lead: Greene County EMA Director
Start Date: March 1, 2015
End Date: March 1, 2020
Funding Source: Local Funds
Action Type: Build safer communities

Action 2.1.2

Appeal to the State to enhance or create wind/impact resistant Ohio Basic Building Code(s)

2015 Status: Ongoing
Project Lead: Greene County EMA Director
Start Date: March 1, 2015
End Date: March 1, 2020
Funding Source: Local Funds
Action Type: Build safer communities

Action 2.1.3 Require compliance and enforcement of existing building codes

2015 Status: Ongoing
Project Lead: Greene County EMA Director
Start Date: March 1, 2015
End Date: March 1, 2020
Funding Source: Local Funds
Action Type: Build safer communities

Action 2.1.4 Encourage mitigation measures for existing development in areas vulnerable to natural hazards

2015 Status: Ongoing
Project Lead: Greene County EMA Director
Start Date: March 1, 2015
End Date: March 1, 2020
Funding Source: Local Funds
Action Type: Build safer communities

Action 2.1.5 Encourage jurisdictions to prevent or prohibit new development in areas vulnerable to natural hazards

2015 Status: Ongoing
Project Lead: Greene County EMA Director
Start Date: March 1, 2015
End Date: March 1, 2020
Funding Source: Local Funds
Action Type: Build safer communities

Action 2.1.6 Encourage watershed and wetland planning, as well as natural resource management in conjunction with land-use planning for natural hazard mitigation

2015 Status: Ongoing
Project Lead: Greene County EMA Director
Start Date: March 1, 2015
End Date: March 1, 2020
Funding Source: Local Funds
Action Type: Build safer communities

Action 2.1.7 Encourage regular and periodic pier inspections for bridges

2015 Status: Ongoing
Project Lead: Greene County EMA Director
Start Date: March 1, 2015
End Date: March 1, 2020
Funding Source: Local Funds
Action Type: Build safer communities

Action 2.1.8 Update dam maintenance programs and services

2015 Status: Ongoing

Project Lead: Greene County EMA Director
Start Date: March 1, 2015
End Date: March 1, 2020
Funding Source: Local Funds
Action Type: Build safer communities

Action 2.1.9 Develop a set of planned alternative routes and gate frequently flooded areas and inform the citizens

2015 Status: Ongoing
Project Lead: Greene County EMA Director
Start Date: March 1, 2015
End Date: March 1, 2020
Funding Source: Local Funds
Action Type: Build safer communities

Action 2.1.10 Encourage the use of vinyl siding to reduce dent damage due to hail incidents

2015 Status: Ongoing
Project Lead: Greene County EMA Director
Start Date: March 1, 2015
End Date: March 1, 2020
Funding Source: Local Funds
Action Type: Build safer communities

Action 2.1.11 Request legislation requiring tornado safe rooms in new mobile home communities and new residential communities without basements

2015 Status: Ongoing
Project Lead: Greene County EMA Director
Start Date: March 1, 2015
End Date: March 1, 2020
Funding Source: Local Funds
Action Type: Build safer communities

Action 2.1.12 Encourage code enforcement and engineering practitioners to enroll in seminars/classes offered by accredited building training centers that showcase the latest materials and techniques in natural hazard resistant construction.

2015 Status: Ongoing
Project Lead: Greene County EMA Director
Start Date: March 1, 2015
End Date: March 1, 2020

Funding Source: Local Funds
Action Type: Build safer communities

Action 2.1.13 Encourage utility companies to hire tree trimming contractors who are capable of a more citizen friendly trimming service

2014 Status: Unchanged
Project Lead: Greene County EMA Director, Mitigation Planning Team
Start Date: March 1, 2015
End Date: March 1, 2020
Funding Source: EMPG, Local Funds
Action Type: Build safer communities

Strategy #2: *Improve hazard assessment information*

Activities:

Action 2.2.1 Local jurisdictions should conduct and maintain an initial damage assessment using all available sources (fire, police, etc.) as soon as possible following a natural event affecting or impeding daily life and business, i.e. road closures due to flooding, winter storms, etc. relative to their jurisdiction as established in the Miami Valley Emergency Operations Plan, 1993, Annex L, *Damage Assessment*, pg L-3.

2012 Status: Completed – this activity was completed by the revision of the Greene County Emergency Operations Plan and the use of Damage Assessment Forms.
Project Lead: Greene County EMA Director
Action Type: *Improve hazard assessment information*

Action 2.2.2 County Emergency Management Agency should collect a detailed damage assessment as established in the Miami Valley Emergency Operations Plan, 1993, Annex L, *Damage Assessment*, PG L-3 (consolidated for the unincorporated jurisdictions and separately for the incorporated areas of the county). Personal property – estimate of losses

2013 Status: Completed – by the creation of Damage Assessment forms that are used by the Greene County EMA and the local jurisdictions.
Project Lead: Greene County EMA Director
Action Type: *Improve hazard assessment information*

Action 2.2.3 Two maps should be generated as established in the Miami Valley Emergency Operations Plan, 1993, Annex L, *Damage Assessment*, PG L-5. One map should graphically display Public damage where the worst damage is located and where minimal damage is located. The second should address the same for Private damages.

2015 Status: Ongoing

Project Lead: Greene County EMA Director
Start Date: March 1, 2015
End Date: March 1, 2020
Funding Source: EMPG, Local Funds
Action Type: *Improve hazard assessment information*

Action 2.2.4 County Emergency Management Agency should retain a natural disaster activity log of all events, damage assessment reports, and a detailed accounting of emergency fiscal expenditures as established in the Miami Valley Emergency Operations Plan, 1993, Annex L, *Damage Assessment*, pg L-5.

2014 Status: Completed – The Greene County EMA maintains all documentation related to disaster events occurring within the county.
Project Lead: Greene County EMA Director
Action Type: *Improve hazard assessment information*

Action 2.2.5 Greene County is in the process of completing a comprehensive GIS data system and when complete, should assess the proximity of any structures to the soil types susceptible to landside as identified in the Minerals and Soils section of Chapter Two, Inventory of Existing conditions.

2014 Status: Completed
Project Lead: Greene County EMA Director
Action Type: *Improve hazard assessment information*

Strategy #3: *Encourage the government, the public, and businesses to create and maintain a sense of safety from natural hazards*

Action Items:

Action 2.3.1 Establish clearly identified places of refuge within public facilities and spaces, neighborhoods, and businesses

2015 Status: Ongoing
Project Lead: Greene County EMA Director
Start Date: March 1, 2015
End Date: March 1, 2020
Funding Source: EMPG, Local Funds
Action Type: *Encourage the government, the public, and businesses to create and maintain a sense of safety from natural hazards*

Action 2.3.2 Establish and encourage the use of weather warning radios in all public spaces

2015 Status: Ongoing
Project Lead: Greene County EMA Director
Start Date: March 1, 2015
End Date: March 1, 2020
Funding Source: EMPG, Local Funds
Action Type: *Encourage the government, the public, and businesses to create and maintain a sense of safety from natural hazards*

Action 2.3.3 Test the effectiveness of tornado sirens

2015 Status: Ongoing
Project Lead: Greene County EMA Director
Start Date: March 1, 2015
End Date: March 1, 2020
Funding Source: EMPG, Local Funds
Action Type: *Encourage the government, the public, and businesses to create and maintain a sense of safety from natural hazards*

Action 2.3.4 Establish and encourage the use of weather warning radios in all business and residences

2015 Status: Ongoing
Project Lead: Greene County EMA Director
Start Date: March 1, 2015
End Date: March 1, 2020
Funding Source: EMPG, Local Funds
Action Type: *Encourage the government, the public, and businesses to create and maintain a sense of safety from natural hazards*

Action 2.3.5 Provide water and shade at all public outdoor events during extreme heat

2015 Status: Ongoing
Project Lead: Greene County EMA Director
Start Date: March 1, 2015
End Date: March 1, 2020

Funding Source: Local Funds
Action Type: *Encourage the government, the public, and businesses to create and maintain a sense of safety from natural hazards*

Action 2.3.6 Establish program(s) providing air conditioning to at-risk populations

2015 Status: Ongoing
Project Lead: Greene County EMA Director
Start Date: March 1, 2015
End Date: March 1, 2020
Funding Source: Local Funds
Action Type: *Encourage the government, the public, and businesses to create and maintain a sense of safety from natural hazards*

Action 2.3.7 Encourage increased use of cold/heat shelters for the homeless

2015 Status: Completed
Project Lead: Greene County EMA Director, Local Jurisdictions
Funding Source: Local Funds
Action Type: *Encourage the government, the public, and businesses to create and maintain a sense of safety from natural hazards*

Goal Three: Create and/or strengthen Partnerships

Situational Analysis #1: The Plan needs a permanent body to supervise the plan activities. The permanent committee/board would be responsible for implementation of the plan, evaluating progress, and updating the plan as necessary. To create a living and sustainable plan

Objective: To create a living and sustainable plan

Strategy: *Create a County Hazard Mitigation Committee/Team to develop sustainable mitigation activities*

Action Items:

Action 3.1.1 Create a County Hazard Mitigation Committee, a partnership of citizens, government, businesses, non-profit organizations – Red Cross, Chamber of Commerce, etc., and social groups, such as the Boy Scouts, Girl Scouts, YMCAs, Eagles, etc.

2014 Status: Completed – by the formation of the Natural Hazard Mitigation Planning Committee.
Project Lead: Greene County EMA Director

Start Date: March 1, 2015
End Date: March 1, 2020
Funding Source: EMPG, Local Funds
Action Type: To create a living and sustainable plan

Action 3.1.2 Appoint a Chairperson for the County Hazard Mitigation Committee

2014 Status: Completed – by the formation of the Natural Hazard Mitigation Planning Committee.
Project Lead: Greene County EMA Director
Start Date: March 1, 2015
End Date: March 1, 2020
Funding Source: EMPG, Local Funds
Action Type: To create a living and sustainable plan

Situational Analysis #2: Property loss, injury, and loss of life are prevented by coordinating efforts to fill the gaps in services, both pre- and post-disaster.

Objective: To involve the community in mitigation and response activities

Strategy: *Create a County Hazard Mitigation Committee/Team to develop a strategy for coordination and participation by public entities, the business community, non-profit organizations, and residents of the county to develop sustainable mitigation activities.*

Action 3.2.1 Work with County Volunteer Corps and other community groups to establish community response teams.

2015 Status: Completed: CERTS and Medical Reserve
Project Lead: Greene County EMA Director
Funding Source: HLSG, Local Funds
Action Type: To involve the community in mitigation and response activities

Action 3.2.2 Partner with organizations whose mission is to restore or preserve beneficial natural systems (wetlands, watersheds, etc.)

2015 Status: Ongoing
Project Lead: Greene County EMA Director
Start Date: March 1, 2015
End Date: March 1, 2020
Funding Source: EMPG, Local Funds
Action Type: To involve the community in mitigation and response activities

Action 3.2.3 Encourage the cooperation of neighbors to include, but not limited to:

- Contingency plans for the evacuation and care of neighboring families and pets and communication among the neighbors in the event of a natural hazard

- Contingency plans for checking-in on the shut-in and frail elderly neighbors

2015 Status: Ongoing
Project Lead: Greene County EMA Director, Local Government, Mitigation Planning Team, and Neighborhood Watch Groups
Start Date: March 1, 2015
End Date: March 1, 2020
Funding Source: Local Funds
Action Type: To involve the community in mitigation and response activities

Goal Four: Create a Safer Environment

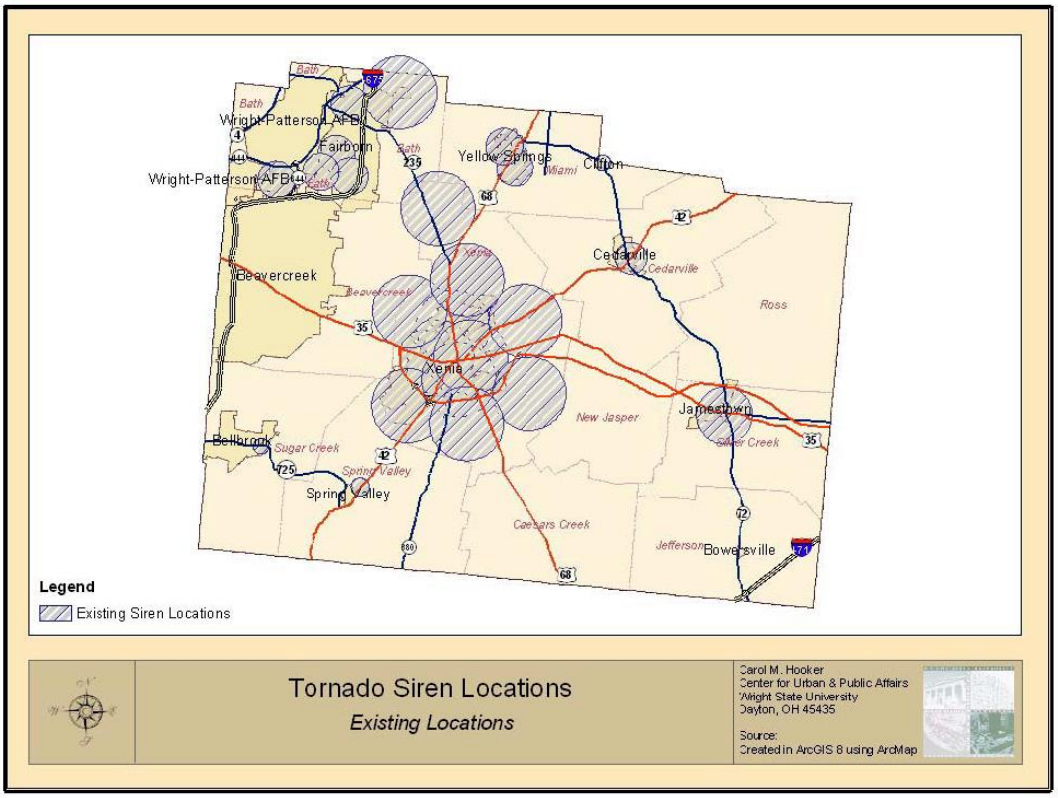
Create a safer environment through construction projects or installation projects of natural hazard safety systems

Situational Analysis #1:

Tornado: Ohio is ranked 5th in the nation when considering frequency of tornadoes, number of fatalities, number of injuries, and cost for damages for tornado disasters. Yet, communities in Greene County do not have adequate tornado siren systems or tornado siren systems at all (Refer to Figure 10-3). Public areas and neighborhoods without basements offer little or no shelter from tornado force winds.

An overlay of the effective siren signal strength identified the following list of communities with inadequate or no tornado siren coverage (Refer to Figure 10-3):

- Bath Township
- Beavercreek
- Bellbrook
- Bowersville
- Ceasarscreek Township
- Cedarville
- Yellow Springs
- Spring Valley
- Spring Valley Township
- Jamestown
- Miami Township
- Beavercreek Township
- Cedarville Township
- Sugarcreek Township
- Ross Township
- Jefferson Township
- Silvercreek Township



- Figure 12-3: Tornado Siren Systems

Flooding: In Greene County, flooding can be expected every year but is most common from April through August when severe thunderstorms bring heavy amounts of rain over a very short period of time or extended periods of rain over a several day period, which cause standing water and/or runoff problems. In addition 2,020 structures exist in the flood plain in Greene County and of these structures, four have repetitive loss claims and face the possibility of flooding over and over again until these structures are removed from their current location or protected from flooding by elevating the structure or providing a permanent protective barrier.

Winter Storms: Greene County also faces the real possibility of yearly heavy snowfall, ice-storms, and blizzard conditions. Winter storms are most common during the months of January and February and most damages are incurred because of lack of preparation.

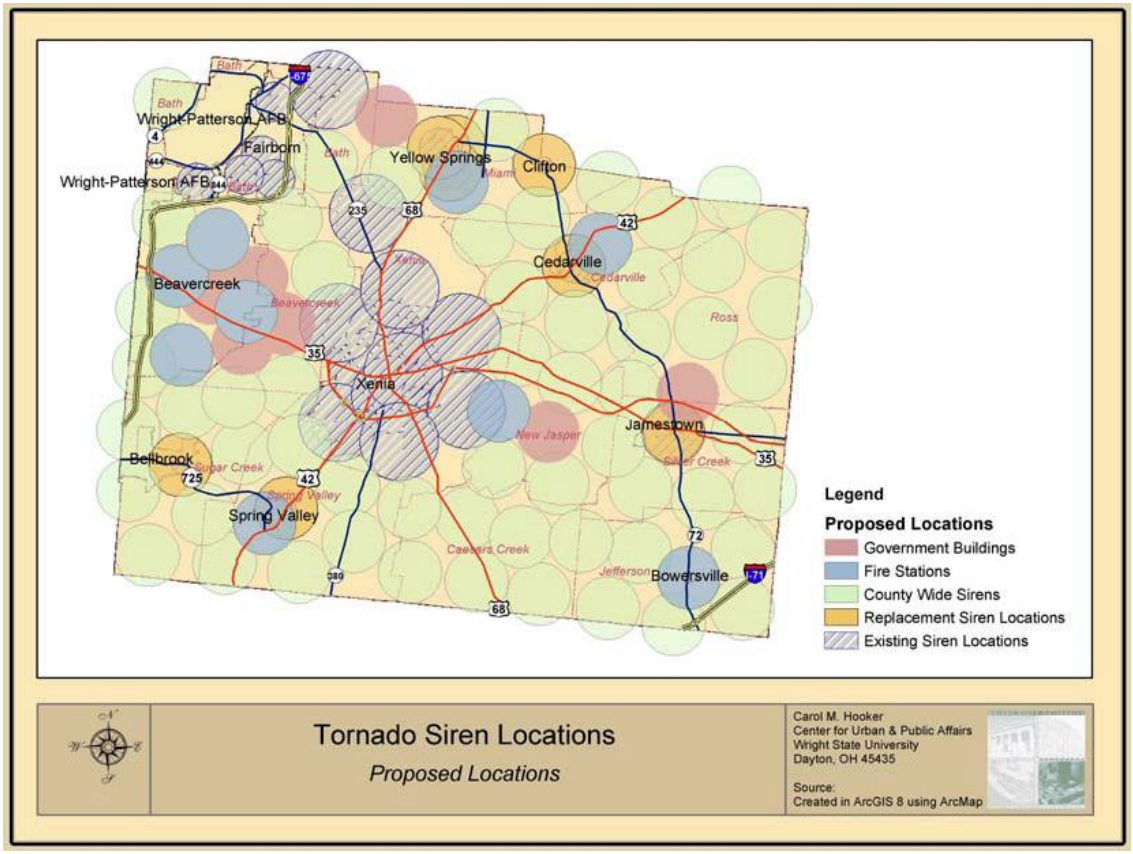
Objective: Develop and implement programs to identify and address the problems of at-risk structures

Strategy: *Install or construct structures and systems, which protect lives by making new and existing structures and areas safer or resistant to damage typically caused by natural hazards*

Action Items:

Action 4.1.1 Seek $2.1 million in funding to install a county-wide tornado warning siren system complete with battery backup in communities with inadequate coverage, or no tornado siren systems:

- Bath
- Beavercreek
- Bellbrook
- Bowersville
- Ceasarsceek Township
- Cedarville
- Yellow Springs
- Spring Valley
- Spring Valley Township
- Jamestown
- Miami Township
- Beavercreek Township
- Cedarville Township
- Sugarcreek Township
- Ross Township
- Jefferson Township
- Silvercreek Township



• Figure 12-4: Tornado Siren Systems – New Installations and Replacements

2015 Status: Ongoing
Project Lead: Greene County EMA Director
Start Date: March 1, 2015
End Date: March 1, 2020
Funding Source: EMPG, Local Funds
Action Type: *Install or construct structures and systems, which protect lives by making new and existing structures and areas safer or resistant to damage typically caused by natural hazards*

Action 4.1.2 In the event a county-wide warning siren system cannot be achieved, the following jurisdictions have requested funding to replace existing equipment or install new equipment.

XENIA TOWNSHIP
Project: Identified need for a tornado siren system.
Project Lead: Xenia Township
Cost: $75,000
2014 Status: Completed **-** This project was funded with Project Impact funding and is currently in progress with the City of Xenia.

JAMESTOWN/SILVERCREEK TOWNSHIP
Project: Identified a need for additional sirens. Jamestown currently has an alert system in the center of town. Estimated Cost: $120,000

2015 Status: Ongoing
Project Lead: Jamestown/Silvercreek Township
Start Date: October 2013
End Date: October 2020
Funding Source: EMPG, Local Funds
Action Type: Create a safer environment through construction projects or installation projects of natural hazard safety systems

NEW JASPER TOWNSHIP -**Project:** Identified need for a tornado siren system.
Estimated Cost**:** $154,000

2015 Status: Ongoing - New Jasper Township is in the planning stage and seeking funding.
Greene County EMA Director, - New Jasper Township
Start Date: March 1, 2013
End Date: March 1, 2020
Funding Source: EMPG, Local Funds
Action Type: Create a safer environment through construction projects or installation projects of natural hazard safety systems

BOWERSVILLE/JEFFERSON TOWNSHIP
Project: Identified need for a tornado siren system.

2014 Status: Ongoing – Bowersville and Jefferson Township are in the planning stage and seeking funding.
Project Lead: Bowersville and Jefferson Township
Estimated Cost: $178,000
Start Date: Oct 2012
End Date: Oct 2021
Funding Source: EMPG, Local Funds
Action Type: Create a safer environment through construction projects or installation projects of natural hazard safety systems

Action 4.1.3 Construct tornado safe rooms in public areas and neighborhoods without basements.

2015 Status: Ongoing
Project Lead: Greene County EMA Director
Start Date: March 1, 2013
End Date: March 1, 2020
Funding Source: EMPG, Local Funds
Action Type: Create a safer environment through construction projects or installation projects of natural hazard safety systems

NFIP Compliance and Floodplain Regulation

Mapping. The county underwent the floodplain map modernization process with FEMA and the Ohio Department of Natural Resources. This process began with a scoping meeting on June 21, 2007 with preliminary maps released on September 19, 2008 and an Open House conducted on December 17, 2008. The appeals and comment period was open on January 25, 2009 and closed on April 25, 2009. The Letter of Final Determination was issued on September 17, 2010. New floodplain maps were adopted by the county and became effective on March 14, 2011.

Floodplain Regulation. The Department of Building Regulation maintains the county's Flood Damage Reduction Resolution. This regulation appoints a county Floodplain Administrator and specifies this position's duties and responsibilities. Some of the duties include, but are limited to routine monitoring of the floodplain, enforcing regulations and providing community assistance such as encouragement for owners to maintain flood insurance.

Risk Mapping, Assessment & Planning (Risk MAP). The Discovery meeting for Risk MAP was conducted on May 3, 2011. The Huffman Dam Pilot Project meeting was held on April 4, 2014, concurrently with the Little Miami Action Discovery meeting for the City of Xenia. The Little Miami Action Discovery meeting for the North Group was later held on April 16, 2014.

Action 4.1.4 Identify at-risk structures in Special Flood Hazard Area

SPECIAL FLOOD HAZARD AREA		FLOOD WAY	FRINGE	BUFFER	TOTAL
JURISDICTION	**Bath Township**		39	6	**45**
	Beavercreek	2	160	50	**212**
	Beavercreek Township	7	41	20	**68**
	Bellbrook	2	114	34	**150**
	Ceasarscreek Township		21	11	**32**
	Cedarville	2	12	9	**23**
	Cedarville Township		11	12	**23**
	Clifton		3	3	**6**
	Fairborn	14	507	79	**600**
	Jamestown		16	14	**30**
	Jefferson Township		21	5	**26**
	Miami Township	4	6	1	**11**
	New Jasper Township		14	27	**41**
	Ross Township		13	11	**24**
	Silvercreek Township		28	28	**56**
	Spring Valley		29	5	**34**
	Spring Valley Township	2	101	38	**141**
	Sugarcreek Township	10	36	32	**78**
	Wright Patterson AFB		88	5	**93**
	Xenia	7	149	82	**238**
	Xenia Township	7	45	35	**87**
	Yellow Springs		2		**2**
Total		**57**	**1456**	**507**	**2020**

• Figure 12-5: Structures in the SFHA

CID	NAME	Init FHBM Identified	Init FIRM Identified	Curr Eff Map Date	Reg - Emer Date	Sanction Date	Does Not Participate
390193	Greene County	7/7/1978	4/1/1981	3/17/2011	4/1/1981		
390876	City of Beavercreek	9/4/1981	8/2/1982	3/17/2011	8/2/1982		
390194	City of Bellbrook	11/2/1974	6/1/1977	3/17/2011	6/1/1977		
390195	City of Fairborn	3/15/1974	11/19/1980	3/17/2011	11/19/1980		
390197	City of Xenia	12/23/1977	1/2/1981	3/17/2011	1/2/1981		
	Village of Bowersville						X
390607	Village of Cedarville	1/10/1975	7/2/1980	3/17/2011	2/24/1981		
390678	Village of Clifton	8/8/1975	7/2/1980	3/17/2011	7/8/1980		
390881	Village of Jamestown		2/1/1984	3/17/2011	2/1/1984		
390196	Village of Spring Valley	11/15/1973	6/1/1980	3/17/2011	6/1/1980		
390640	Village of Yellow Springs	10/18/1974	9/4/1985	3/17/2011	9/4/1985		

Action 4.1.5 Seek funding for the acquisition, elevation, or retrofit of structures with repetitive loss flood insurance claims through voluntary[28] (owner) mitigation activities.

SUGARCREEK TOWNSHIP
Project**:** One property has been identified as a repetitive flood insurance loss property in Sugarcreek Township on Washington Mill near the Sugarcreek. Worst Case $119,910 for property acquisition at the current 100% assessed value plus the cost of structural demolition (Average cost equals $0.25/ft.^{3} and will vary based on the number of structural levels above ground, building materials, and sublevels contained in the structure.)[29]

2015 Status: Ongoing
Project Lead: Sugarcreek Township
Start Date: March 1, 2012
End Date: March 1, 2016
Funding Source: Local Funds
Action Type: Create a safer environment through construction projects or installation projects of natural hazard safety systems

FAIRBORN
Project: One property has been identified as a repetitive flood insurance loss property in the City of Fairborn on Harvard near Kaufman. Worst Case $48,990 for property acquisition at the current 100% assessed value plus the cost of structural demolition (Average cost equals $0.25/ft.^{3} and will vary based on the number of structural levels above ground, building materials, and sublevels contained in the structure.)[30]

2015 Status: Ongoing
Project Lead: City of Fairborn
Start Date: Oct 2012
End Date: Oct 2016
Action Type: Create a safer environment through construction projects or installation projects of natural hazard safety systems

BEAVERCREEK
Project: One property has been identified as a repetitive flood insurance loss property in the City of Beavercreek on Patterson Rd. However, insufficient data was provided to determine the exact location of this property because no address was provided. Cost unknown. Exact location of the property must first be obtained.

2014 Status: Ongoing
Project Lead: City of Beavercreek
Start Date: Oct 2012
End Date: Oct 2016
Action Type: Create a safer environment through construction projects or installation projects of natural hazard safety systems

XENIA TOWNSHIP
Project: One property has been identified as a repetitive flood insurance loss property in Xenia Township on Washington near State Route 68. Worst Case $155,990 for property acquisition at the current 100% assessed value plus the cost of structural demolition (Average cost equals $0.25/ft.^{3} and will vary based on the number of structural levels above ground, building materials, and sublevels contained in the structure.)[31]

2014 Status: Ongoing
Project Lead: Xenia Township
Start Date: Oct 2012
End Date: Oct 2016
Action Type: Create a safer environment through construction projects or installation projects of natural hazard safety systems

[28] Voluntary Mitigation Activities means the owner voluntarily agrees to sell the property when the cost of elevating the structure or retrofitting the structure exceeds 50% of the structure's value.
[29] Stark Wrecking, 7081 Germantown Pike, Dayton, OH 45342, (937) 866-5032.
[30] Stark Wrecking, 7081 Germantown Pike, Dayton, OH 45342, (937) 866-5032.
[31] Stark Wrecking, 7081 Germantown Pike, Dayton, OH 45342, (937) 866-5032

Action 4.1.6 Prioritize removal and /or relocation of at-risk structures or construction of improved or new storm drainage systems or levees to protect at-risk structures

2015 Status: Unchanged
Project Lead: Local Jurisdictions
Start Date: March 1, 2015
End Date: March 1, 2020
Funding Source: Local Funds
Action Type: *Install or construct structures and systems, which protect lives by making new and existing structures and areas safer or resistant to damage typically caused by natural hazards*

Action 4.1.7 Seek funding for removal and /or relocation of at-risk structures or construction of improved or new storm drainage systems or levees to protect at-risk structures

2015 Status: Unchanged
Project Lead: Local Jurisdictions
Start Date: March 1, 2015
End Date: March 1, 2020
Funding Source: Local Funds
Action Type: *Install or construct structures and systems, which protect lives by making new and existing structures and areas safer or resistant to damage typically caused by natural hazards*

Action 4.1.8 Remove and/or relocate at-risk structures or construction of improved or new storm drainage systems or levees to protect at-risk structures

2015 Status: Unchanged
Project Lead: Local Jurisdictions
Start Date: March 1, 2015
End Date: March 1, 2020
Funding Source: Local Funds
Action Type: *Install or construct structures and systems, which protect lives by making new and existing structures and areas safer or resistant to damage typically caused by natural hazards*

Action 4.1.9 Seek funding for new storm drainage systems or levees to protect at-risk structures

JAMESTOWN
Project: Identified need for storm water drainage in the southwestern portion of the village and is currently seeking funding for this project. Cost unknown

2014 Status: Ongoing
Project Lead: Village of Jamestown
Start Date: Oct 2012

End Date: Oct 2016
Action Type: Create a safer environment through construction projects or installation projects of natural hazard safety systems

2014 Status: Ongoing
YELLOW SPRINGS
Project**:** Identified the need for a storm water retention pond in the Glass Farm area of the Village and is currently seeking funding.

2014 Status: Ongoing
Project Lead: Village of Yellow Springs
Start Date: Oct 2012
End Date: Oct 2016
Action Type: Create a safer environment through construction projects or installation projects of natural hazard safety systems

Action 4.1.10 Construct or repair storm drainage systems and or levees

BELLBROOK
Project: Identified the need for routine cleaning of the catch basins in the City, especially in flood prone areas to eliminate this secondary source of flooding.

2015 Status: Ongoing – Bellbrook currently practices routine cleaning and plans to continue annual review and follow-up maintenance of existing culverts to ensure that construction remains sound and able to contain water flow.
Project Lead: City of Bellbrook, Greene County Emergency Management Agency Manager, Local Jurisdiction Manager or Administrator
Start Date: March 1, 2015
End Date: March 1, 2020
Funding Source: Local Funds
Action Type: *Install or construct structures and systems, which protect lives by making new and existing structures and areas safer or resistant to damage typically caused by natural hazards*

New Projects

GREENE COUNTY
Project #1: High impact window coverings for jail
Project Lead: Greene County Sheriff
Est. Cost: $100,000
Timeline: Mar 2014 to Mar 2018

Project #2: Generator upgrade for jail
Project Lead: Greene County Sheriff
Est. Cost: $50,000
Timeline: Mar 2014 to Mar 2018

Project #3: Tornado Safe Rooms for Kitridge Rd., Spangler Rd., and Spring Valley and SR 725 *Trailer Parks
Project Lead: Greene County Sheriff
Est. Cost: $120,000
Timeline: Mar 2014 to Mar 2018

Project #4: Upgrade windows to high impact windows on schools
Project Lead: Greene County EMA and local jurisdictions
Est. Cost: $200000
Timeline: Mar 2014 to Mar 2018

Project #5: Establish a Flood Diversion program for roads in Greene County using the Hyper Reach mass notification system
Project Lead: Greene County EMA and local jurisdictions
Est. Cost: $20000
Timeline: Mar 2014 to Mar 2018

CITY OF FAIRBORN
Project #1: Pleasant View Drainage, Phase I Construction (Redbank Parallel Trunk Sewer)
Project Lead: City of Fairborn
Est. Cost: $509,000
Timeline: Mar 2014 to Mar 2018

Project #2: Pleasant View Drainage, Phase II Design (Dellwood Drive Sewer)
Project Lead: City of Fairborn
Est. Cost: $46,000
Timeline: Mar 2014 to Mar 2018

Project #3: Pleasant View Drainage, Phase II Construction (Dellwood Drive Sewer)
Project Lead: City of Fairborn
Est. Cost: $375,000
Timeline: Mar 2014 to Mar 2018

Project #4: Pleasant View Drainage, Phase III Design (Florence Ave Sewer)
Project Lead: City of Fairborn
Est. Cost: $60,000
Timeline: Mar 2014 to Mar 2018

Project #5: Pleasant View Drainage, Phase III Construction (Florcence Ave Sewer)
Project Lead: City of Fairborn
Est. Cost: $659,000
Timeline: Mar 2014 to Mar 2018

Project #6: Pleasant View Drainage, Phase IV Design & Construction (Pat Lane & NE Sewer)
Project Lead: City of Fairborn
Est. Cost: $584,000
Timeline: Mar 2014 to Mar 2018

Project #7: Chapel Drive at Sycamore Storm Drainage Materials
Project Lead: City of Fairborn
Est. Cost: $22,000
Timeline: Mar 2014 to Mar 2018

Project #8: Upper Orville Street Storm Improvements Design & Construction
Project Lead: City of Fairborn
Est. Cost: $30,000
Timeline: Mar 2014 to Mar 2018

Project #9: Hebble Creek Culvert Replacement, Central Ave
Project Lead: City of Fairborn
Est. Cost: $246,000
Timeline: Mar 2014 to Mar 2018

Project #10: Hebble Creek Culvert Replacement, Elm and Dayton Drive
Project Lead: City of Fairborn
Est. Cost: $197,000
Timeline: Mar 2014 to Mar 2018

Project #11: Adams St/Mitman Park Drainage Design
Project Lead: City of Fairborn
Est. Cost: $105,000
Timeline: Mar 2014 to Mar 2018

Project #12: Adams St/Mitman Park Drainage Construction
Project Lead: City of Fairborn
Est. Cost: $861,000
Timeline: Mar 2014 to Mar 2018

Project #13: Enclose Redbank Ditch between Kauffman and Maple Ave.
Project Lead: City of Fairborn
Est. Cost: $1,124,000
Timeline: Mar 2014 to Mar 2018

Project #14: Hidden Hills Detection Basin Modifications
Project Lead: City of Fairborn
Est. Cost: $1,021,000
Timeline: Mar 2014 to Mar 2018

Project #15: Lincoln Drive Storm Sewer Improvements Construction
Project Lead: City of Fairborn
Est. Cost: $75,000
Timeline: Mar 2014 to Mar 2018

Project #16: Ironwood Drive Storm Sewer, Design & Construction
Project Lead: City of Fairborn
Est. Cost: $2,693,000
Timeline: Mar 2014 to Mar 2018

Project #17: Langview/Royal Oaks Storm Sewer Design & Construction
Project Lead: City of Fairborn
Est. Cost: $839,000
Timeline: Mar 2014 to Mar 2018

Project #18: Redstone Drive Storm Sewer Design & Construction
Project Lead: City of Fairborn
Est. Cost: $1,364,000
Timeline: Mar 2014 to Mar 2018

Project #19: Highview Drive Storm Sewer Design and Construction
Project Lead: City of Fairborn
Est. Cost: $552,000
Timeline: Mar 2014 to Mar 2018

Project #20: Stormwater Master Plan
Project Lead: City of Fairborn
Est. Cost: $61,000
Timeline: Mar 2014 to Mar 2018

Project #21: Dayton Yellow Springs Drainage Improvement - Commerce Center Area
Project Lead: City of Fairborn
Est. Cost: $309,000
Timeline: Mar 2014 to Mar 2018

Project #22: Col Glenn Drainage Improvements
Project Lead: City of Fairborn
Est. Cost: $268,000
Timeline: Mar 2014 to Mar 2018

Project #23: Redbank Ditch Retaining Wall Replacement
Project Lead: City of Fairborn
Est. Cost: $75,000
Timeline: Mar 2014 to Mar 2018

Project #24: Hebble Creek Engineering Study
Project Lead: City of Fairborn
Est. Cost: $57,000
Timeline: Mar 2014 to Mar 2018

Project #25: Hebble Creek Creek Reprofiling
Project Lead: City of Fairborn
Est. Cost: $258,000
Timeline: Mar 2014 to Mar 2018

Project #26: Kauffman Ave. Drainage Improvements
Project Lead: City of Fairborn
Est. Cost: $283,000
Timeline: Mar 2014 to Mar 2018

Project #27: Drainage Area Easement Procurements
Project Lead: City of Fairborn
Est. Cost: $52,000
Timeline: Mar 2014 to Mar 2018

Project #28: Beaver Control Measures
Project Lead: City of Fairborn
Est. Cost: $21,000
Timeline: Mar 2014 to Mar 2018

Project #29: Wrightview Park Plat Storm Sewer
Project Lead: City of Fairborn
Est. Cost: $215,000
Timeline: Mar 2014 to Mar 2018

Project #30: Fairfield Park Drainage Improvements
Project Lead: City of Fairborn
Est. Cost: $258,000
Timeline: Mar 2014 to Mar 2018

Project #31: Fairfield Park Pervious Pavement of Parking Lots
Project Lead: City of Fairborn
Est. Cost: $180,000
Timeline: Mar 2014 to Mar 2018

Project #32: Circle Drive Storm Drainage Improvements
Project Lead: City of Fairborn
Est. Cost: $335,000
Timeline: Mar 2014 to Mar 2018

Project #33: Mark Lane Ditch Renovation
Project Lead: City of Fairborn
Est. Cost: $232,000
Timeline: Mar 2014 to Mar 2018

Project #34: E. Third Street Retaining Wall Repair and Replacement (E. Collier St. to 300 ft. downstream of S. Whiteman St.)
Project Lead: City of Xenia
Est. Cost: $1,500,000
Timeline: Mar 2014 to Mar 2018

Project #35: Sycamore Street Property Acquisitions (3 structures and 5 parcels of land that are prone to flooding)
Project Lead: City of Xenia
Est. Cost: $200,000
Timeline: Mar 2014 to Mar 2018

Project #36: Massie Creek US 68 North Property Acquisition; Kaufman/Washington Mill/Patterson
Project Lead: Greene County
Est. Cost: $500,000
Timeline: Mar 2015 to Mar 2020

Completed Projects

Jurisdictions within Greene County continued to do disaster mitigation projects. The following is a list of completed projects that reduce loss, provide awareness, and improve response in the event of a disaster or major event:

Countywide Communications System Project and CAD software: All jurisdictions/police/fire/state government agencies are now on the same communications system and can communicate in the event of a major incident or disaster. Completed in 2013

Acquisition – Xenia Township: Acquired a group of 5 residences near the WWTP for well field protection. Completed in 2012-2014

Public Notification/Warning System: Hyper Reach - Completed in 2012

Community Tornado Shelter – Xenia, Ohio Completed in 2008-2009
Private Sector Tornado Shelter – Xenia, Ohio Completed in 2009-2010

Flood Plain Map Revised. Completed March 17, 2011

Policy for Use of Government Channels for Public Information: Completed in 2011

CERT Public Education Program has trained a total of 519 citizens to date.

Medical Reverse Corp Public Education Program has trained a total of 201 volunteers to date.

Chapter

12 Plan Maintenance

As illustrated in the Goals and activities, a permanent body, the Mitigation Planning Team, will be responsible for plan implementation, evaluation, and consequently updating the plan based on their findings. This committee is extension of the original Mitigation Planning Team and a sub-committee of the Greene County Emergency Preparedness Committee and represents volunteer, partnering agencies and resident interests.

The committee oversees the implementation of this plan and review progress on county and jurisdictional projects. The committee meets at the minimum, on an annual basis. Some jurisdictions report updating their projects on a quarterly basis and more frequent meetings may be necessary to accommodate such changes.

In addition to the committee's responsibilities, local jurisdictions must also play their part. The hazard assessment provided in this report provides the ground work for the local jurisdictions to begin reviewing and revising local ordinances and codes, as well as adopting the projects set forth by the planning committee into upcoming comprehensive plans and fiscal budgets.

The ideal venue for reviewing and incorporating the hazard analysis and plan might be the citizen planning commissions and zoning review boards. This incorporates public involvement while helping to minimize the involvement of local government staff and cost in the process and formalizes the process for reviewing and adopting mitigation planning efforts. Citizen planning and zoning review boards would be responsible for making recommendations to the jurisdiction's Planning/Zoning staff and Council or Board. However, the method by which the review, revision and implementation process is formally adopted is up to the local jurisdictions.

Countywide projects should be Project Leaded by the Greene County Emergency Management Agency and approved by the Board of County Commissioners. Jurisdictional projects will be submitted to the local jurisdictions to be approved by the City Council or the Township trustees and integrated into comprehensive plans, capital improvement plans, zoning and building codes, site reviews, permitting, and other planning tools, where such tools are the appropriate vehicles for implementation.

Yearly, the local jurisdictions must provide documentation to Greene County Emergency Management Agency of the process for which review, revision and implementation has occurred and an updated list of completed and proposed projects. In addition, the local jurisdictions should provide a complete record of storm events and the problems, which the community faced as a result of the storm event.

The Greene County Emergency Management Agency will be responsible for collecting the data on a regular basis and disseminating the research and documentation to the Mitigation Planning and Review Team. The planning team will then be responsible for implementing a program for the analysis this data and consequently would also be responsible for updating the plan to reflect the new conditions. The Team

will also be responsible for involving the public in maintaining and updating the plan through regularly scheduled strategic meetings, and providing the all changes to the plan on the website and in public libraries.

This plan will be reviewed by the planning team and revision made at least at a minimum of every five years as required by Title 44 Code of Federal Regulations section 201.6(c)(4)(i).

As jurisdictions update or adopt new projects or as new hazard data becomes available the changes will be presented to the Greene County Emergency Management Agency for review. The completed projects will be removed, revision will be updated, and new projects will be incorporated into the plan then submitted to the County Board of Commissioners and Ohio Emergency Management Agency for approval as needed.

Appendix A

Public, Private, and Governmental Participation in the Project

2014 Planning Team

Anders, Rosanne – Greene County Emergency Management Agency
(937-562-5994) - randers@ co.greene.oh.us

Rettig, Gary - Greene County Emergency Management Agency
(937-562-5994) - gcema@ co.greene.oh.us

Leopold, Deb – Greene County Combined Health District
(937)374-5600 - dleopold@gcchd.org

Brown, Mike - Greene County Sherriff's Office
(937-562-4800) - mbrown@ co.greene.oh.us

Prindle, Eric – Greene County Sherriff's Office
(937-562-4800) - eprindle@ co.greene.oh.us

Bowman, Rick - – Greene County Sherriff's Office
(937-562-4800) - rbowman@ co.greene.oh.us

O'Shaughnessy, Fran – American Red Cross
(937)222-6711 – foshaughnessy@dac.redcross.org

Neidhar, Jim – City of Bellbrook Fire Department
(937-848-3272 - J.Neidhard@cityofbellbrook.org

Riley, Mike – City of Fairborn Fire Department
937-754-3080 – mriley@ci.fairborn.oh.us

Berger, Chris – City of Xenia Public Works
(937)37 cberger@ci.xenia.oh.us

Mercs, John – Beavercreek Township Fire Department
(937)426-1213 -jmercs @beavercreektownship.org

Participating Jurisdictions and Contact Information

City of Beavercreek
Mike Cornell
1368 Research Park Dr.
Beavercreek, Ohio 45432
(937)320-7388

City of Bellbrook
Mark Schlagheck
15 E. Franklin St.
Bellbrook, OH 45305
(937)848-4666

City of Fairborn
Chief Mike Riley
44 W. Hebble Ave.
Fairborn, OH 45324
(937)754-3030

City of Xenia
Chris Berger
101 N. Detroit St.
Xenia, OH 45385
(937)376-7232

Village of Jamestown
Mayor Jerrod Pickens
84 Seaman Dr.
Jamestown, OH 45335
(937) 675-5311

Village of Spring Valley
Brent Bonecutter
7 W. Main St.
PO Box 418
Spring Valley OH, 45370
(937) 862-4485

Village of Yellow Springs
Mayor David Foubert
100 Dayton St.
Yellow Springs, OH 45387
(937) 767-3401

Village of Bowersville
3192 Maysville St.
P.O. Box 306
Bowersville, OH 45307
(937) 453-2266

Village of Cedarville
Chief Scott Baldwin
11 E. Xenia Ave P.O. Box 51
Cedarville, OH 45314
(937) 766-2061

Village of Clifton
Mayor James Alexi Bieri
P.O. Box 27
Clifton, OH 45316
Phone: (937) 767-7400/767-1767

Bath Township
Elaine Brown
1006 Yellow Springs-Fairfield Rd.
Fairborn, OH 45324
(937) 878-0611

Beavercreek Township
Alex Zaharieff
1981 Dayton-Xenia Rd.
Beavercreek, OH 45434
(937) 429-4472

Caesarscreek Township
2034 E. Spring Valley-Paintersville Rd.
Xenia, OH 45385
(937) 372-8711

Cedarville Township
Chief Scott Baldwin
78 N. Main St.
Cedarville, OH 45314
(937) 766-1851

Jefferson Township
Linda Fliehman
3188 Maysville St.
PO Box 116
Bowersville, OH 45307
(937) 453-2571

Miami Township
Chief Colin Aultman
225 Corry St.
Yellow Springs, OH 45387
(937) 767-2460

New Jasper Township
Doug McDaniel
3121 Jasper Rd.
Xenia, OH 45385
(937) 372-4140

Ross Township
Lee Snell
1740 S. Charleston Rd
Jamestown, OH 45335
(937) 675-5231

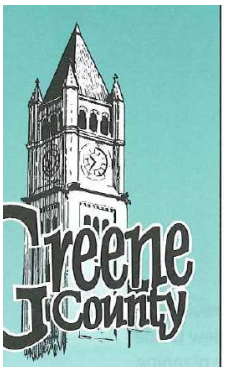
Silvercreek Township
Melissa Smith
3 N. Sycamore St.
Jamestown, OH 45335
(937) 675-2877

Spring Valley Township
Kitty Crocket
2547 US Rt. 42 South
PO Box 147
Spring Valley, OH 45370
(937) 862-4532

Sugarcreek Township
Randy Pavlak
26 E. Franklin St.
Bellbrook, OH 45305
(937) 848-8426

Xenia Township
Alan Stock
8 Brush Row Rd.
Xenia, OH 45385
(937) 372-0859

Letter Inviting Contiguous Counties to Participate in the Planning Process



November 4, 2013

Greene County Emergency Management Agency is in the process of revising its Natural Hazard Mitigation Plan. The FEMA Local Mitigation Plan Review Guide recommends notification of adjoining counties as stakeholders in the planning process. We are notifying you of our plan revision to ensure an integrated and coordinated planning effort.

We invite you to join in our planning process and welcome your participation. If you would like to participate please contact our office for further information.

Thank you for your assistance.

Sincerely,

Rosanne Anders, Director
Greene County Emergency Management Agency

The following contiguous county's EMA Directors were contacted:

Clark Co Emergency Mgmt.
Director: D`Allessandris, Lisa
3130 East Main St. Suite 1E
Springfield, OH 45505
937 521-2175

Clinton Co Emergency Mgmt.
Director: Jones, Mike
1645 Davids Drive
Wilmington, Oh 45177
937 382-6673

Fayette Co Emergency Mgmt.

Miami Co Emergency Mgmt.
Director: Artz, Kenneth
210 Marybill Drive
Troy, Oh 45373
937 332-8560

Montgomery County Office of Emergency Management
Director: Jordan, Jeffrey J.
117 S. Main St. Ste. 721
Dayton, Oh 45422
937 224-8936

Director: Terry, Fulton
133 South Main Street. Suite L15
Washington CH, Oh 43160
740 335-8264

Madison Co Emergency Mgmt.
Director: Roberts, Roger
271 Elm Street
London, Oh 43140
740 852-4200

Warren Co Emergency Services Agency
Director: Bunner, Michael
500 Justice Drive
Lebanon, Oh 45036
513 695-1315

March 24, 2014

For Immediate Release

Contact: Rosanne Anders (937)562-5994

Greene County Natural Hazard Mitigation Plan

The Greene County Emergency Management Agency is soliciting public comment regarding revisions to the Greene county Natural Hazard Mitigation Plan. A copy of the plan is available at www.co.greene.oh.us/index.aspx?nid=191.

Revisions to the plan will be discussed at the Greene County Emergency Preparedness meeting held on May 7, 2014 at the Greene County Health Department, 306 Wilson Drive, Xenia Ohio 45385 at 2:00 p.m.

Public Meeting

Greene County Natural Hazard Mitigation Plan

The Greene County Emergency Management Agency is soliciting public comment regarding revisions to the Greene county Natural Hazard Mitigation Plan.

May 7, 2014

2:00 p.m

Greene County Health Department

306 Wilson Drive, Xenia Ohio 45385

CERT
NOAA Weather Radio
Safe & Well
Safety Checklists & Information

COMMUNITY ALERTS
FIND A JOB
ONLINE PAYMENTS
NOTIFY ME
REPORT A CONCERN

The EMA provides a comprehensive Emergency Management program which coordinates people and resources in order to protect the lives, property, and the environment within Greene County. These goals will be achieved by using an all hazards approach of mitigation, preparedness, response and recovery to avert or minimize the effects of an emergency or natural or man-made disaster.

Greene County Natural Hazard Mitigation Plan

The Greene County Natural Hazard Mitigation Plan is a stand-alone plan that identifies priorities and projects designed to reduce the impact of disasters on communities. By maintaining a current hazard mitigation plan, the county and local jurisdictions are eligible for federal mitigation funds as they become available. In order to complete this process we are asking the public to provide comments on the revision of the plan. For your comparison, the links below will take you to the current version and the proposed revised version of the plan.

Current Greene County Natural Hazard Mitigation Plan

Proposed Greene County Natural Hazard Mitigation Plan Revisions

Please direct all comments regarding the plan revisions to gcema@co.greene.oh.us

Citizen Sign-up

Greene County has instituted the Hyper-Reach Emergency Notification System - an ultra high-speed telephone communication service for emergency notifications. This system allows us to telephone all or targeted areas of the county in the event of emergency situations or critical community alerts.

Examples include:

- Bio-terrorism alerts
- Boil alert notices
- Chemical spills
- Evacuation notices
- Missing child reports
- Tornado warnings

You can use Hyper-Reach to submit additional

Director
Email

45 N. Detroit St.
Lower Level
Xenia, OH 45385

Ph: (937) 562-5994
Fx: (937) 562-5995

NEWS

What You Need to Know about Ebola
While Ebola does not pose an imminent risk to Ohio residents, out of an abundance of caution the Ohio Department of Health is working with local entities. Read on...

VIEW ALL

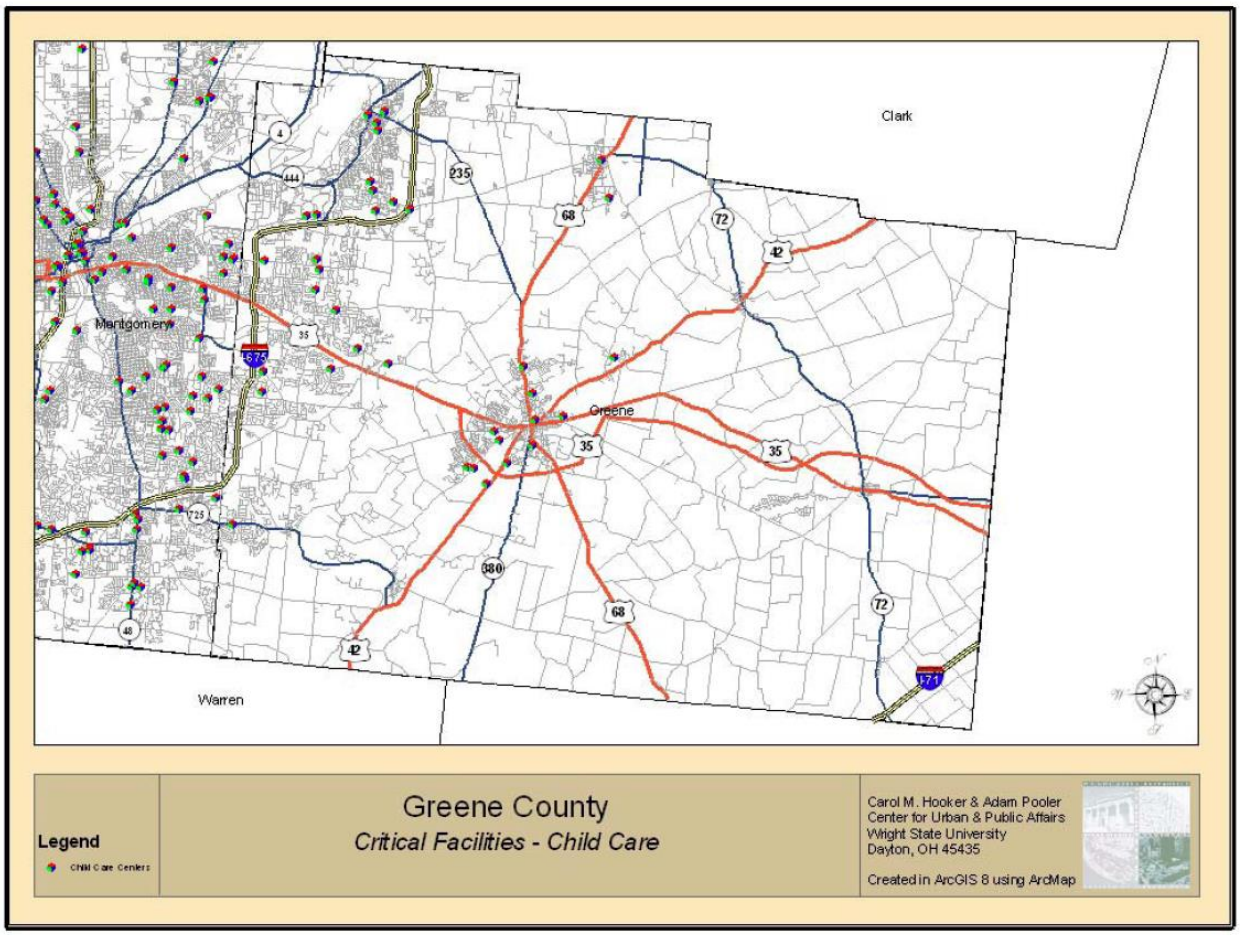
QUICK LINKS

- Federal Emergency Management Agency
- Ohio Emergency Management Agency

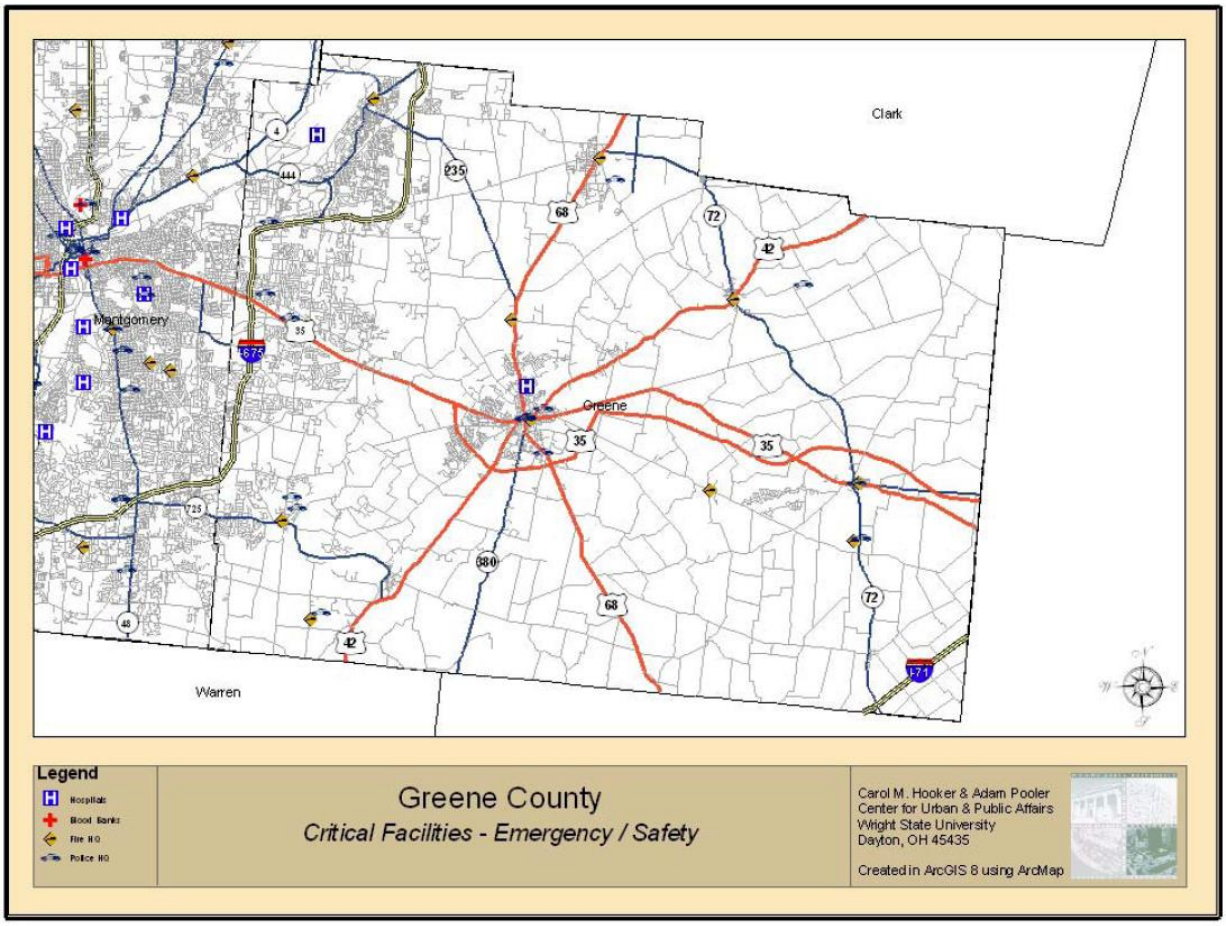
VIEW ALL

Appendix
B

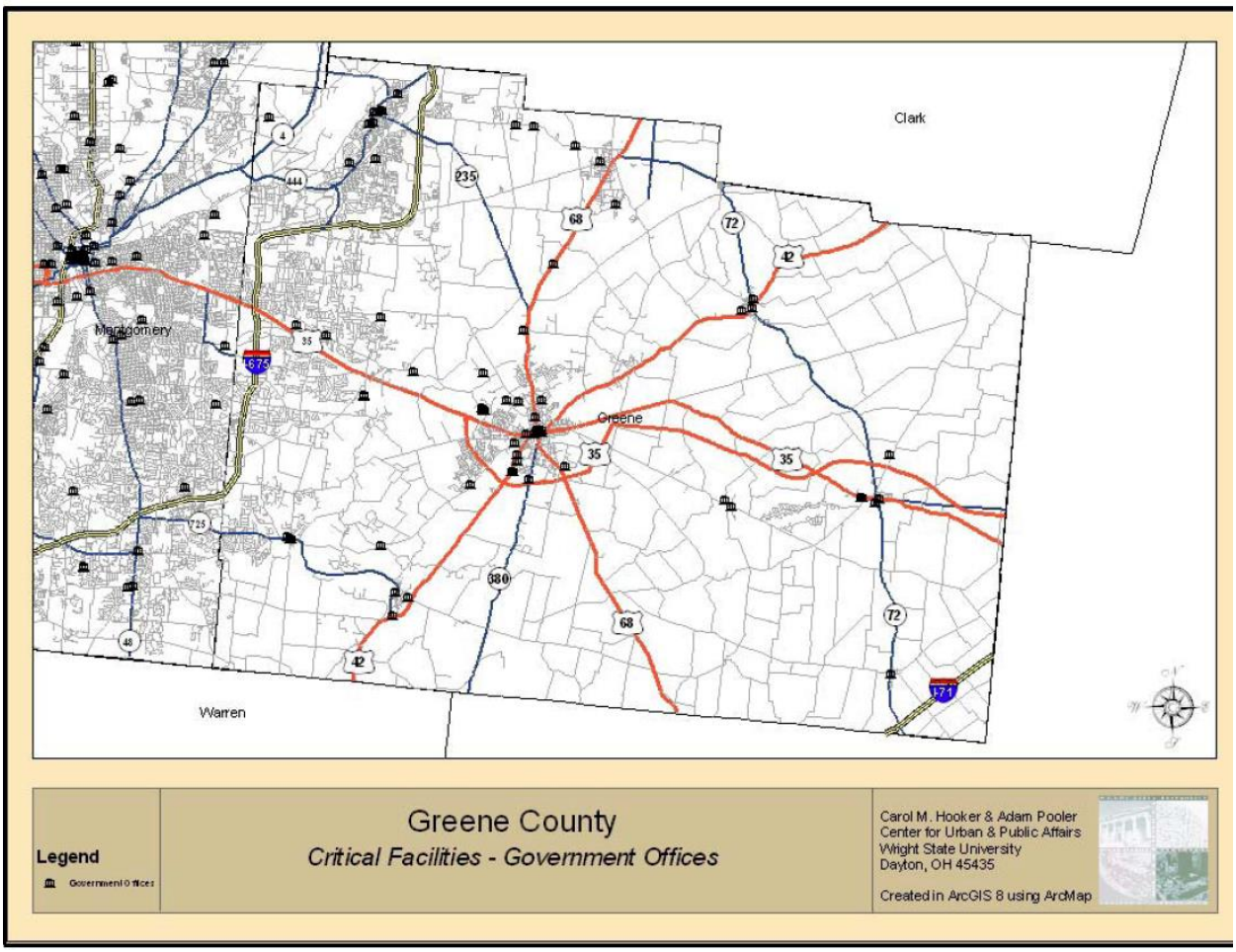
Critical Facilities



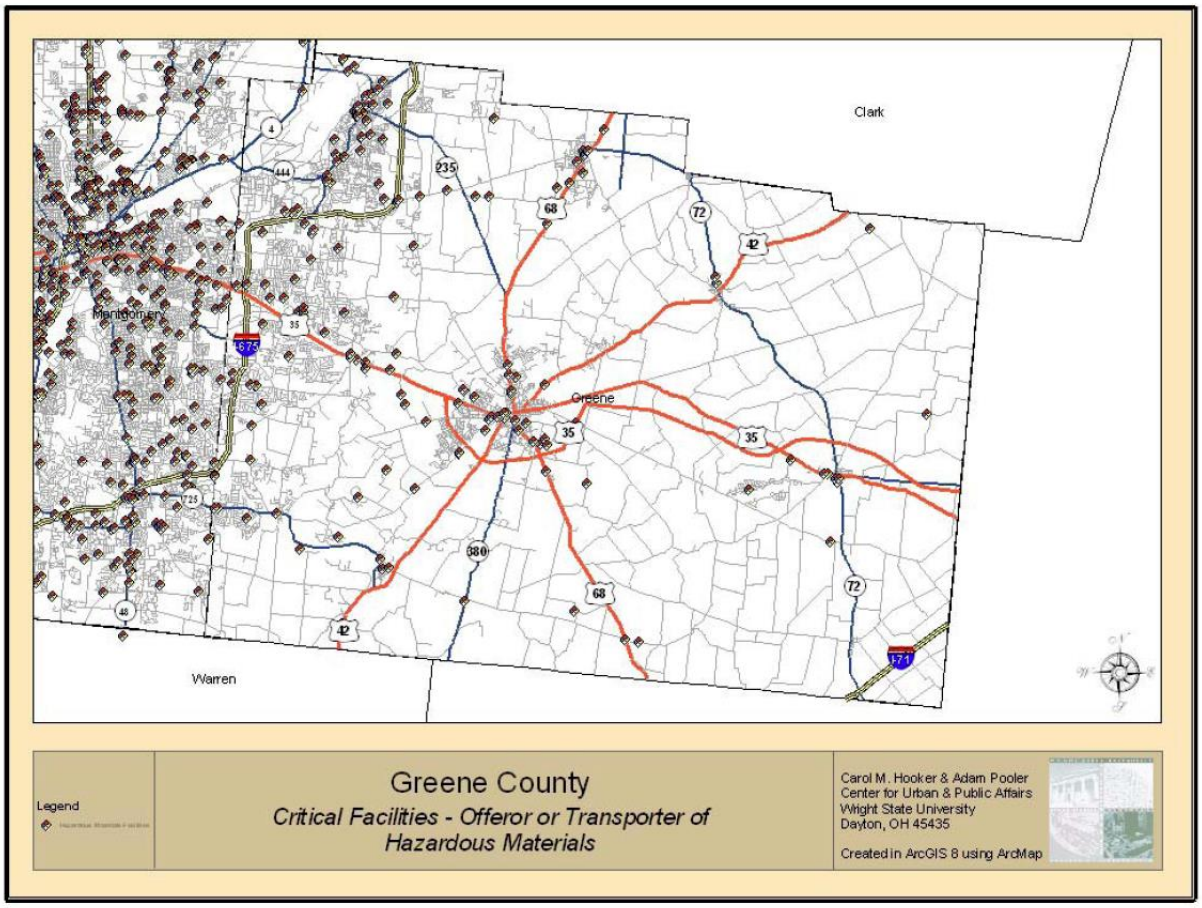
• Figure B-1: Child Care Facilities



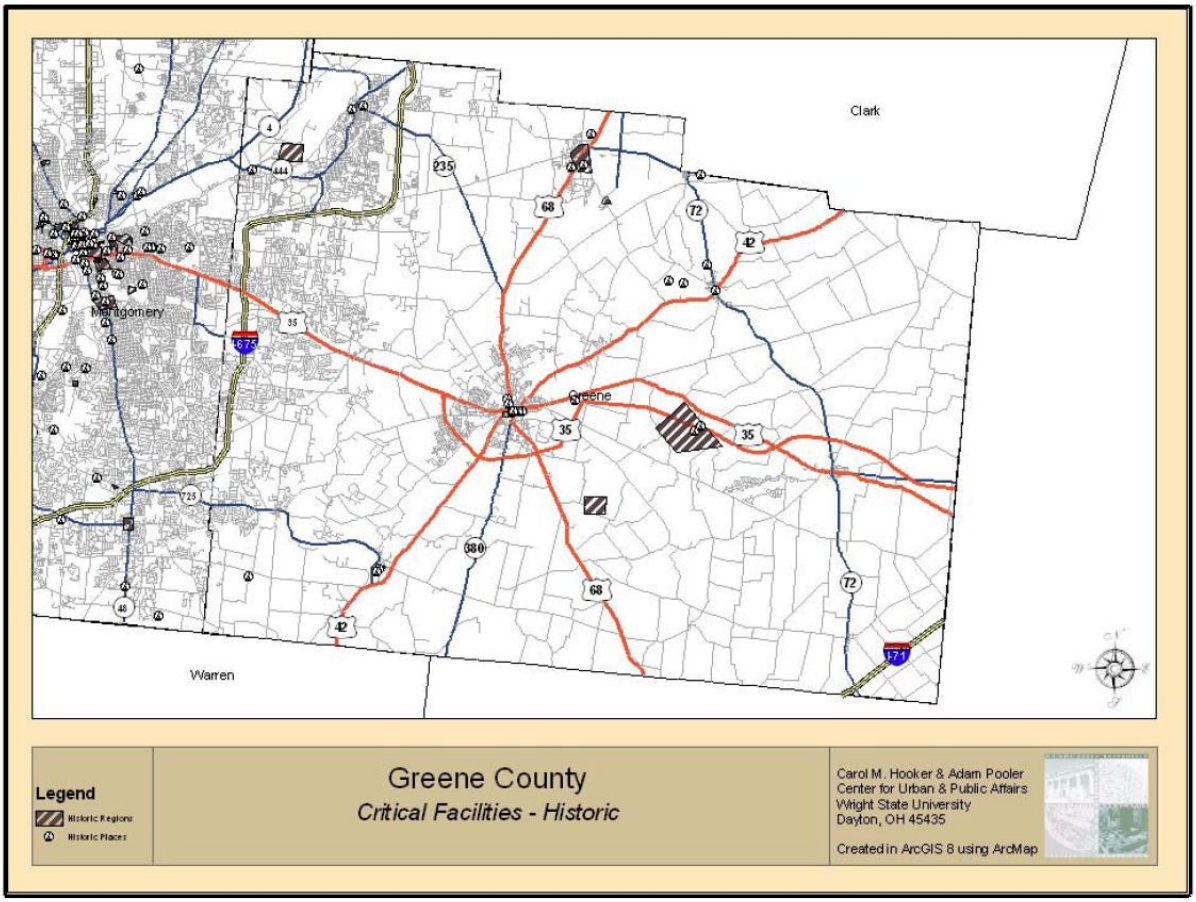
• Figure B-2: Emergency and Safety Critical Facilities



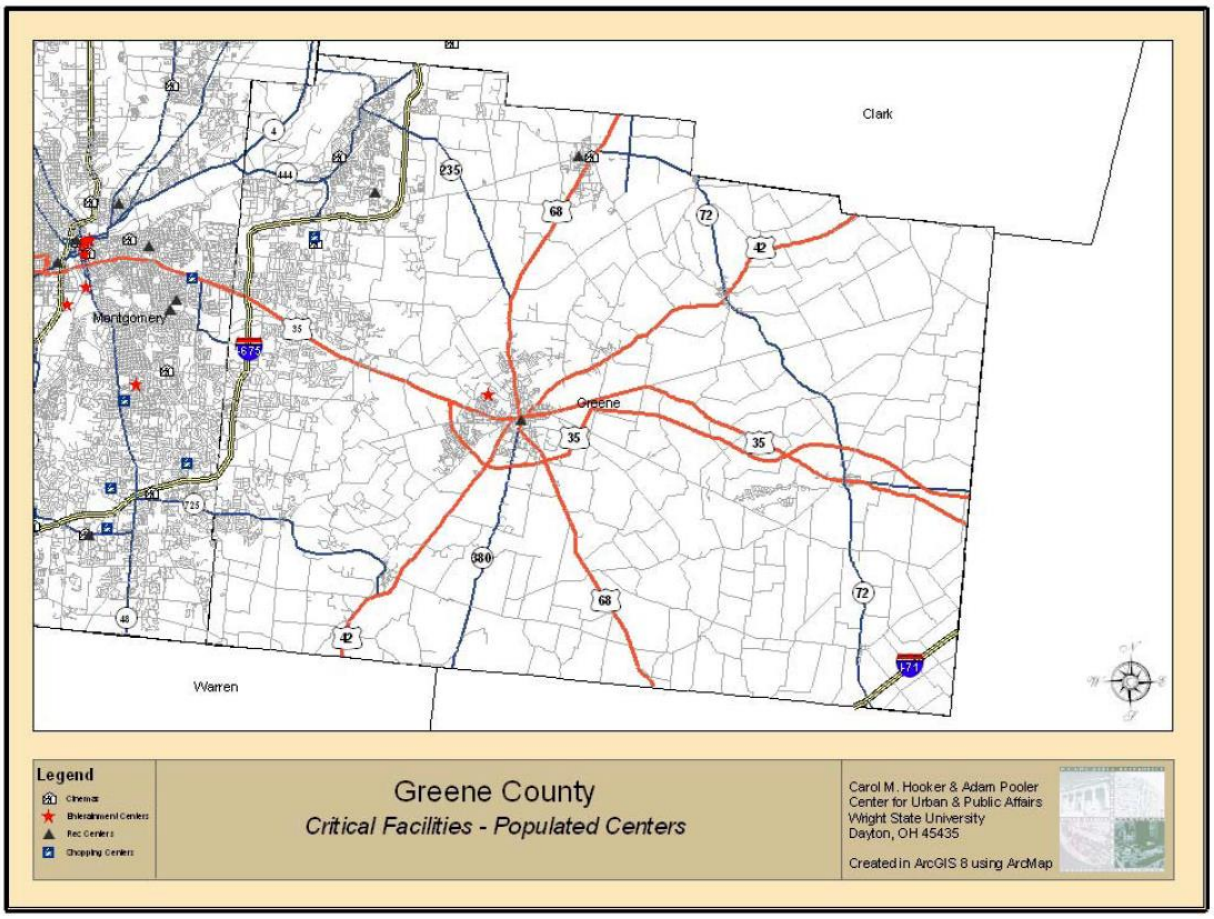
• Figure B-3: Government Facilities



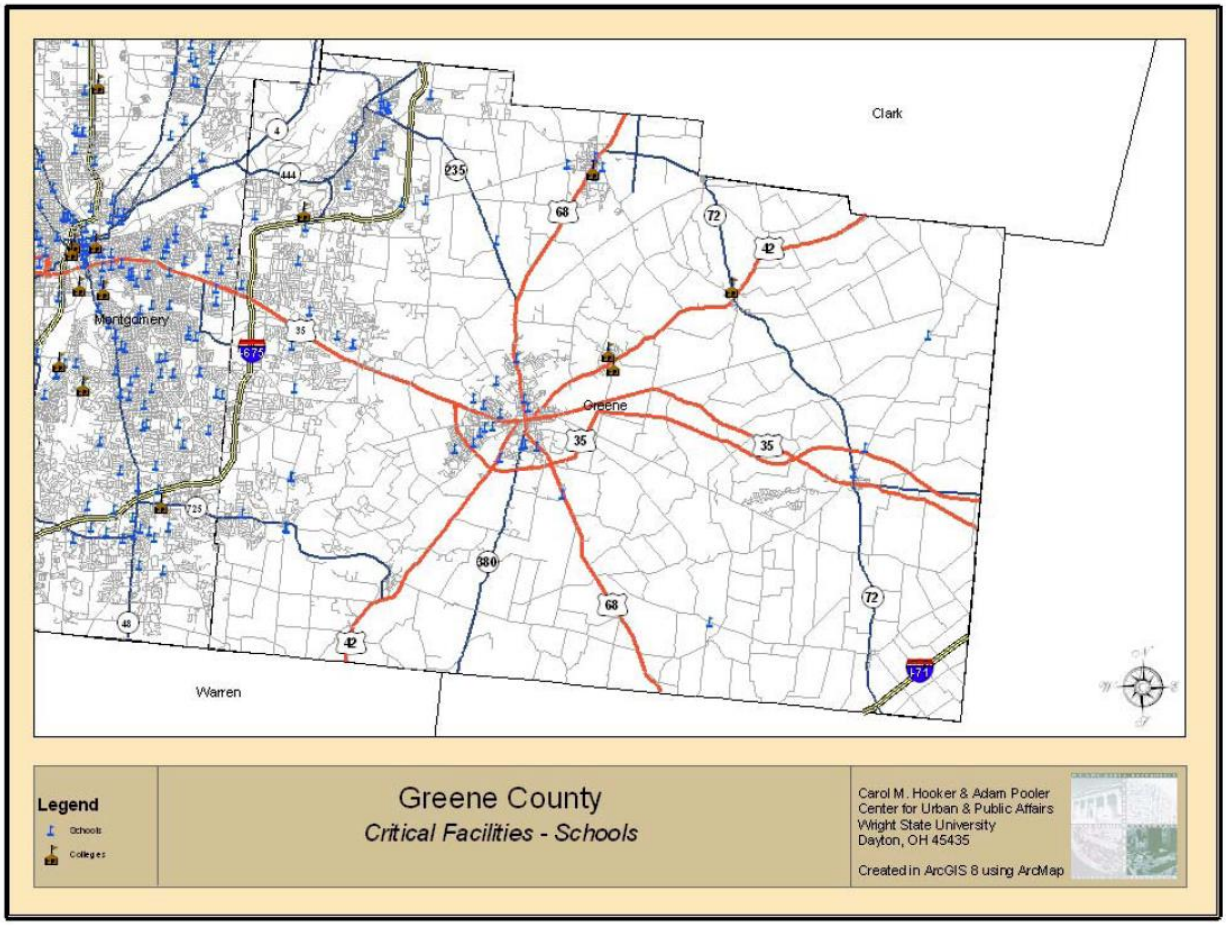
• Figure B-4: Offeror or Transporter of Hazardous Materials



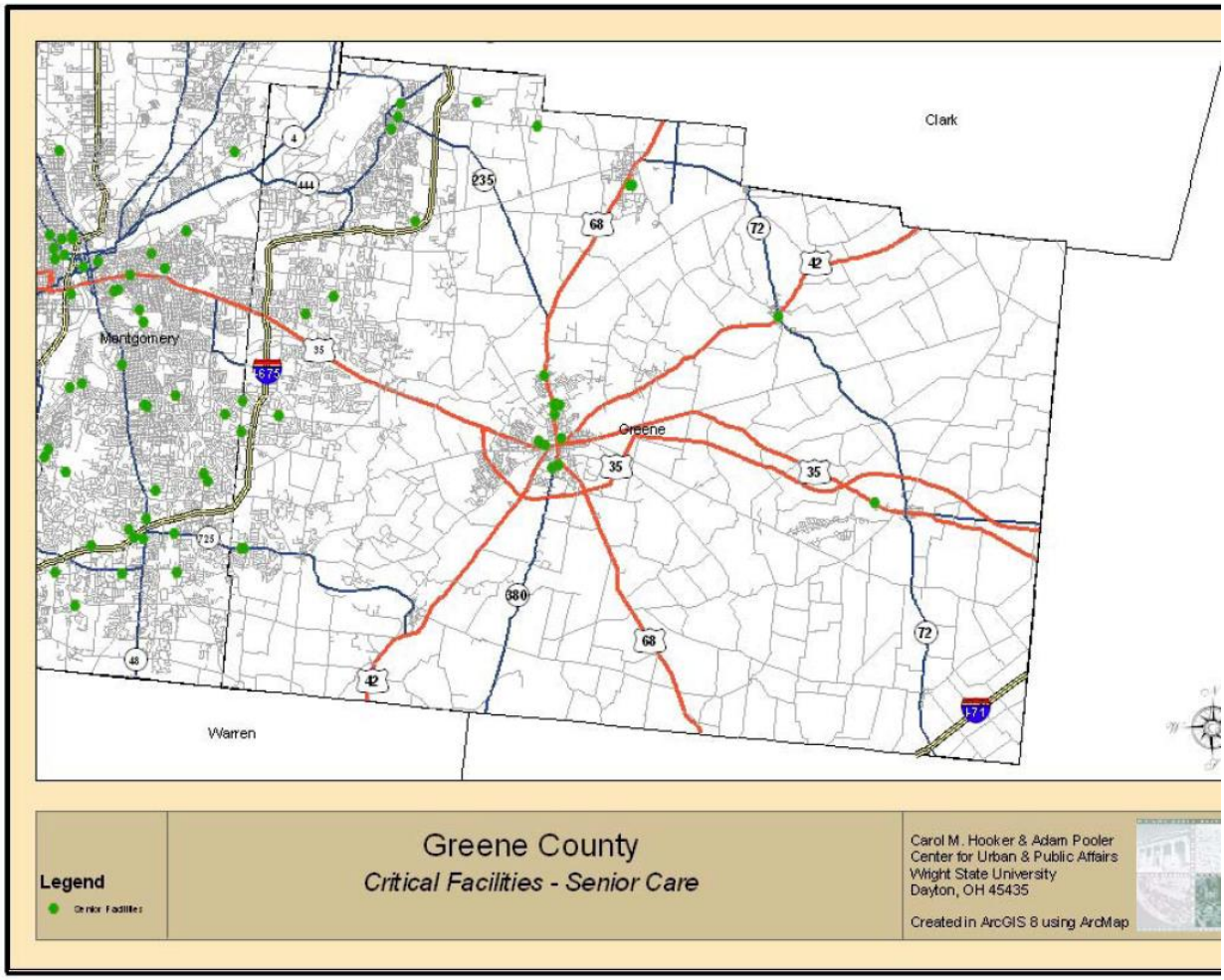
• Figure B-5: Historic Structures and Historic Districts



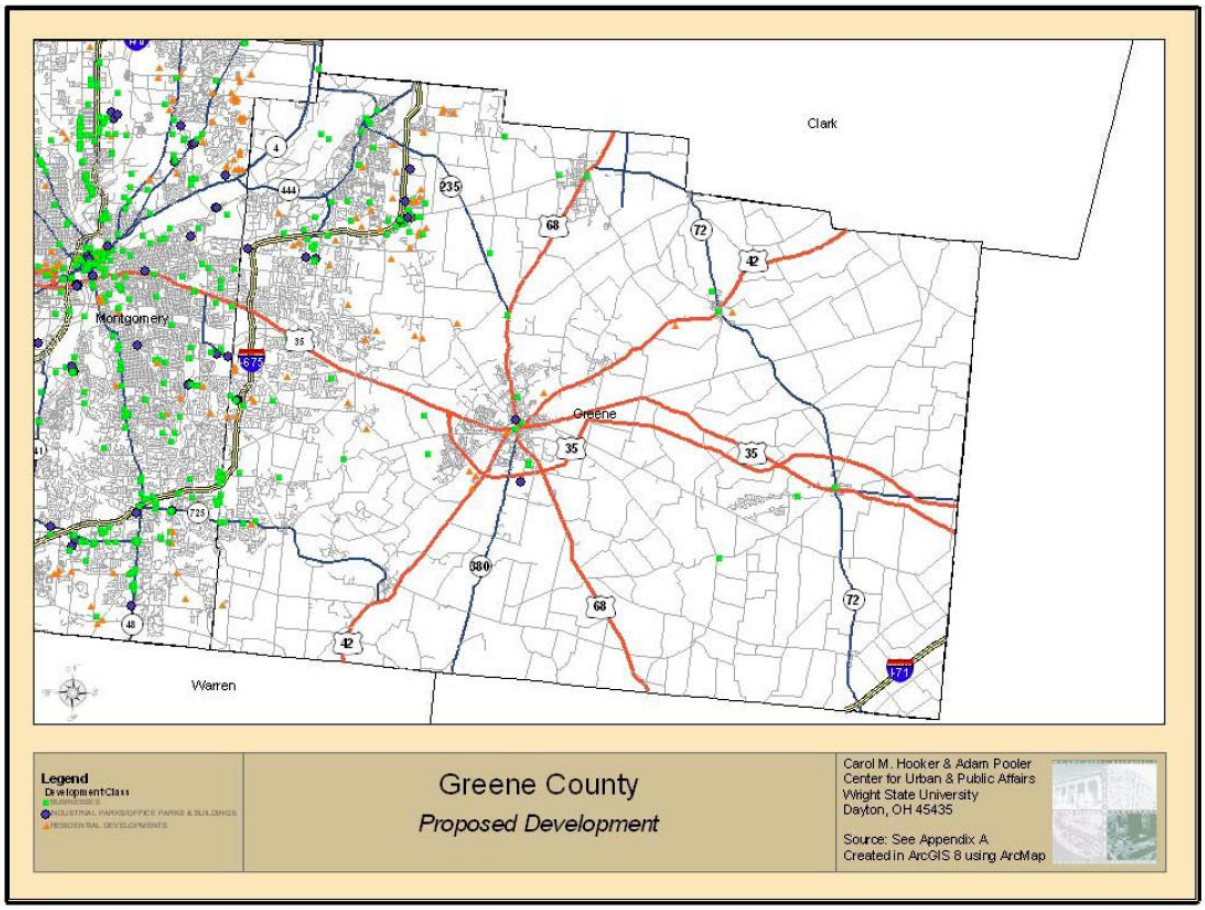
• Figure B-6: Recreation and Shopping Facilities



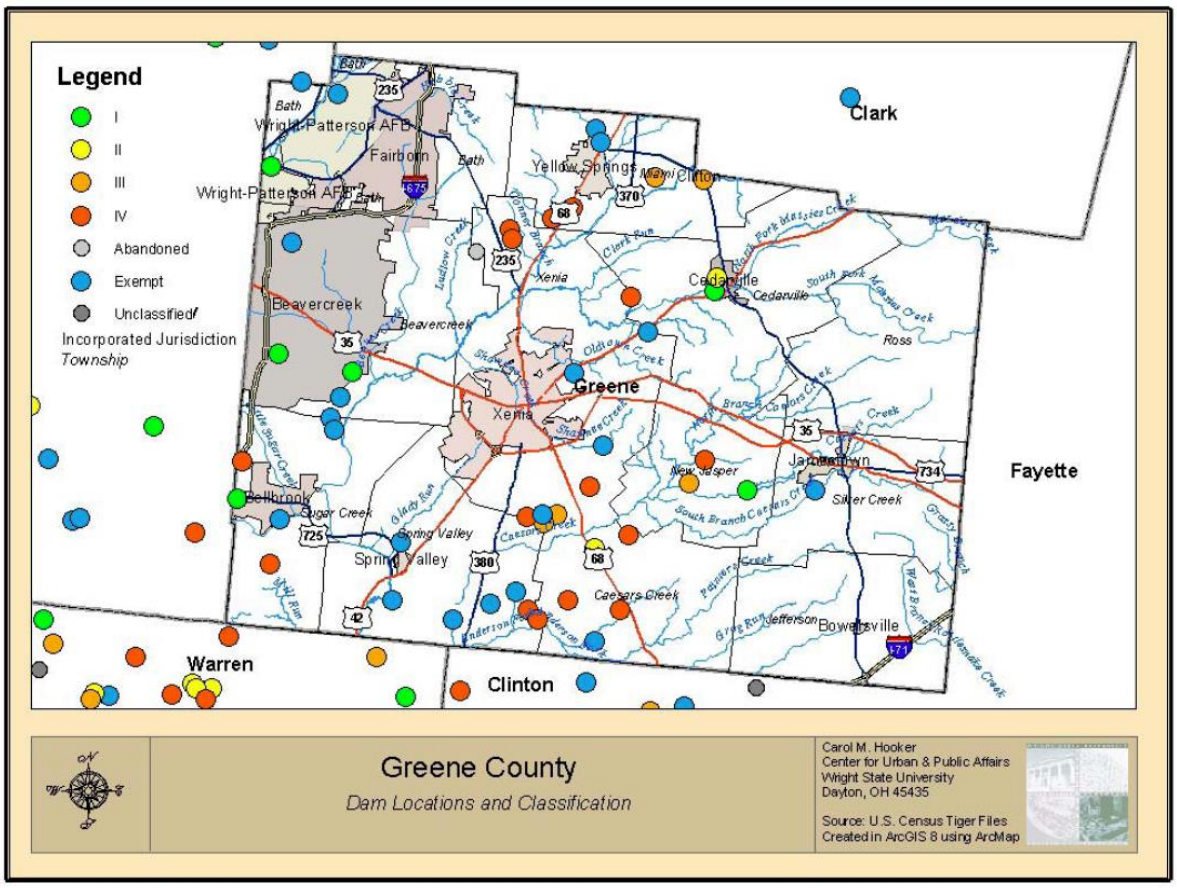
• Figure B-7: Educational Facilities



• Figure B-8: Senior Care Facilities



• Figure B-9: Proposed Development



• Figure B-10: Dam Locations and Classifications

Dam Safety: Classification of Structures[32]

Classification of dams is defined in the Ohio Administrative Code (OAC), Section 1501:21-13-01. Dams which are exempt from the Ohio Department of Natural Resources, Division of Water jurisdiction are defined in Ohio Revised Code, Section 1521.06. The classification system divides dams which are under the jurisdiction of the Division of Water into four classes, Class I, II, III, and IV. The chief of the Division of Water determines the class of a dam during the preliminary design review for a new structure (OAC Rule 1501:21-5-02) and/or during the periodic inspection of existing structures (OAC Rule 1501:21-21-01). Classification of dams is necessary to provide proper design criteria and to ensure adequate safety factors for dams according to the potential for downstream damage should the dam fail.

The classification system for dams in Ohio was modeled after the Federal Guidelines for Dam Safety established in 1979. The following parameters are the governing criteria for the classification: (See illustration on back)

1. Height of dam - defined as the vertical dimension as measured from the natural streambed at the downstream toe of a dam to the low point along the top of the dam.

2. Storage volume - defined as the total volume impounded when the pool level is at the top of the dam immediately before it is overtopped.

3. Potential downstream hazard - defined as the resultant downstream damage should the dam fail, including probable future development.

The classification criteria are outlined in OAC Rule 1501:21-13-01 and summarized in the following list:

Height of Dam

Class I - greater than 60 feet

Class II - greater than 40 feet

Class III - greater than 25 feet

Class IV - less than or equal to 25 feet

Storage Volume

Class I - greater than 5000 acre-feet

[32] Copied in its entirety from the Ohio Department of Natural Resources http://www.dnr.state.oh.us/water/pubs/fs_div/fctsht29.htm

Class II - greater than 500 acre-feet

Class III - greater than 50 acre-feet

Class IV - less than or equal to 50 acre-feet

Potential Downstream Hazard

Class I - probable loss of life, serious hazard to health, structural damage to high value property (i.e., homes, industries, major public utilities)

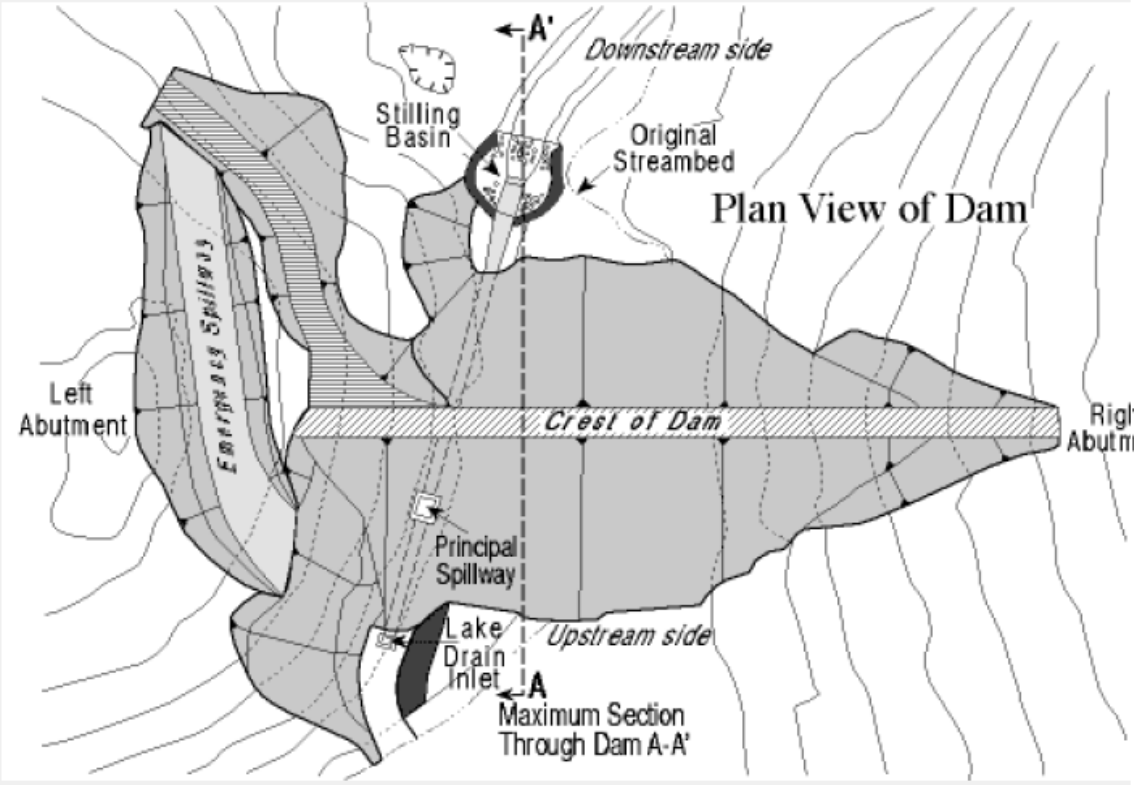
Class II - flood water damage to homes, businesses, industrial structures (no loss of life envisioned), damage to state and interstate highways, railroads, only access to residential areas

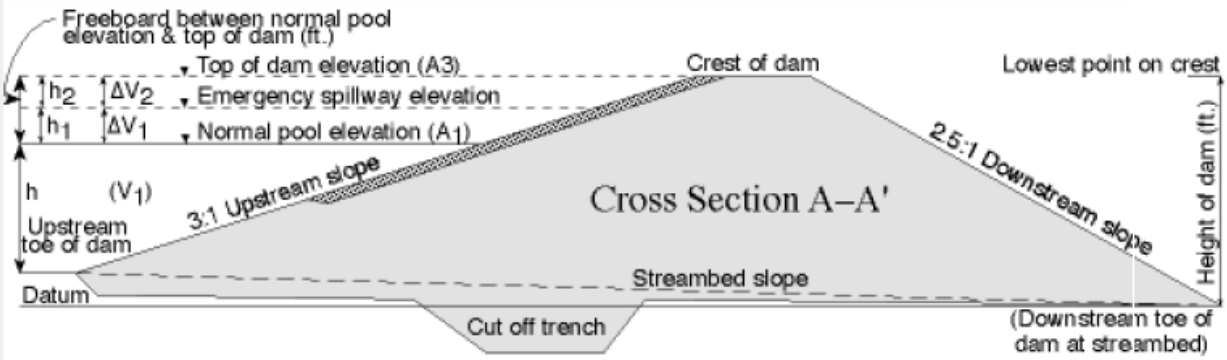
Class III - damage to low value non-residential structures, local roads, agricultural crops and livestock

Class IV - losses restricted mainly to the dam

Each dam would be evaluated on the preceding criteria and placed in the highest class that any one of these criteria might meet. The Division of Water, in accordance with the ORC Section 1521.062 and OAC Rule 1501:21-13-01 (C), has the right to reclassify any dam as a result of a change in circumstances not in existence at the time of the initial classification.

A dam is exempt from the state's authority under ORC Section 1521.062 if it is 6 feet or less in height regardless of total storage; less than 10 feet in height with not more than 50 acre-feet of storage, or not more than 15 acre-feet of total storage regardless of height.





$$V_{TOD} = V_1 + \Delta V_1 + \Delta V_2$$

V_{TOD} = Storage volume of lake pool when at top of dam

V_1 = Storage volume at normal pool elevation: $\frac{h}{3} A_1$

ΔV_1 = Incremental volume between normal pool and emergency spillway elevation: $\frac{h_1}{3}(A_1 + A_2 + \sqrt{A_1 A_2})$

ΔV_2 = Incremental volume between emergency spillway and top of dam elevation: $\frac{h_2}{3}(A_2 + A_3 + \sqrt{A_2 A_3})$

A_1 = Lake surface area at normal pool elevation

A_2 = Lake surface area at emergency spillway elevation

A_3 = Lake surface area at top of dam elevation

For additional information please contact:

The Ohio Department of Natural Resources
Division of Water
Engineering Group
1939 Fountain Square
Columbus, OH 43224-1385
Phone (614) 265-6731
Fax (614) 447-9503
E-mail: water@dnr.state.oh.us

Jurisdiction – Bath Township			
Facility – Government	**Population**	**Contact**	**Number & email**
Bath Township		Elaine Brown	(937) 878-0611
1006 Yellow Springs-Fairfield Rd.			
Fairborn, OH 45324			
*Notes:			

Jurisdiction – Beavercreek			
Facility - Government	**Population**	**Contact**	**Number & email**
City of Beavercreek		City Manager – Mike Cornell	(937)427-5500
1368 Research Park Dr.			fax (937)427-5544
Beavercreek, OH 45432			
*Notes:			
Beavercreek Police Department		Chief: Dennis Evers	9-1-1 or 426-1225
1388 Research Park Drive			fax (937) 427-5526
Dayton, OH 45432			
*Notes:			
Beavercreek Waste Water			562-7167
Treatment Facility			
420 Factory Rd			
Beavercreek			
*Notes:			
Beavercreek Water Treatment		Ken French	562-7100
1122 Beaver Valley Rd			
Beavercreek			
*Notes:			
Beavercreek Water Treatment		Ken French	562-7100
2772 Shakertown Rd			
Beavercreek			
*Notes:			

US Post Office – Alpha			426-7257
748 Alpha Rd.			
*Notes:			
US Post Office – Beavercreek			426-6644
3541 Dayton-Xenia Rd			
*Notes:			
Facility – Daycares	**Population**	**Contact**	**Number & email**
Aley United Methodist Church	60	Jennifer Heaton	426-0830
Childhood Development Center			
4143 Kemp Rd.			
Beavercreek			
*Notes:			
Beavercreek Christian Learning Center	350	Debbie Black	426-0079
1850 N. Fairfield Rd.			
Beavercreek			
*Notes:			
Beavercreek Precious Ones	150	Penny Babcock	429-9858
Learning Center			
3009 Shakertown Rd.			
Beavercreek			
*Notes:			
Bright Beginnings	90	Sharon Wetzel	426-6222
2973 Lantz Rd.			
Beavercreek			
*Notes:			
Days of Discovery	112		427-3297
2122 Beaverpark Dr.			

Beavercreek			
*Notes:			
Evergreen Childrens Center	75	Jill Gordon	426-6674
2659 Dayton-Xenia Rd.			
Beavercreek			
*Notes:			
The Goddard School	120	Kim McCaslin	427-2966
1423 Grange Hall Rd.			
Beavercreek			
*Notes:			
Kindercare Learning Center	99		
2221 N. Fairfield			
Beavercreek			
*Notes:			
Young Learners World	76	Ann Grieser	426-5437
2308 Lakeview Dr.			
Beavercreek			
*Notes:			
Facility - Schools	**Population**	**Contact**	**Number & email**
Beavercreek High School	2,472	Marion West	Office# (937) 429-7547
2660 Dayton-Xenia Rd			Fax (937) 429-7546
Beavercreek, OH 45434			
*Notes:			
E.G. Shaw Elementary	723	Nick Verhoff	(937) 429-7610
3560 Kemp Rd.			Fax (937) 429-7690
Beavercreek, OH 45431			
*Notes:			

Fairbrook Elementary	611	Deron Schwieterman	(937) 429-7616
260 North Fairfield Road			Fax (937) 429-7687
Beavercreek, OH 45430			
*Notes:			
Ferguson Middle School	928	Brad Wolgast	(937) 429-7577
2680 Dayton-Xenia Rd			Fax (937) 429-7686
Beavercreek, OH 45434			
*Notes:			
Herman Ankeney Middle School	871	Pam Taicklet	(937) 429-7567
4085 Shakertown Rd			Fax (937) 429-7685
Beavercreek, OH 45430			
*Notes:			
Main Elementary	867	Tom Dvorak	(937) 429-7588
2942 Dayton-Xenia Rd			Fax (937) 429-7688
Beavercreek, OH 45434			
*Notes:			
Parkwood Elementary	578	Ann-Olivia Westfield	(937) 429-7604
1791 Wilene Dr			Fax (937) 429-7684
Beavercreek, OH 45432			
*Notes:			
Valley Elementary	536	Lisa Walk	(937) 429-7597
3601 Jonathan Dr			Fax (937) 429-7691
Beavercreek, OH 45434			
*Notes:			
St. Luke Elementary	453	Leslie Vondrell	937-426-8551
1442 N. Fairfield Rd			
Beavercreek OH			
*Notes:			

Facility – Hospitals & Urgent Cares	**Population**	**Contact**	**Number & email**
GMH UrgentCare Beavercreek			937-458-4200
3371 Kemp Rd.			
Beavercreek			
*Notes:			
Facility – Nursing Homes	**Population**	**Contact**	**Number & email**
Brookdale-Sterling House	33	Kristen Penrod - Administrator	431-0455
3839 Indian Ripple Rd.			
Beavercreek, OH			
*Notes: No generator			
Heartland of Beavercreek	100	Ginny Foley - Director	Ginny Foley - Director
1974 N. Fairfield Rd.			
Beavercreek			
*Notes: Generator 4 days			
Trinity Community of Beavercreek	214	Laura Farrell - Administrator	426-8481
3218 Indian Ripple Rd			
Beavercreek, OH			
*Notes: Generator 24 hours			
Grand Court	42	Connie Daniels Administrator	427-0060
280 Walden Way			
427-0060			
*Notes			
Facility – Senior Independent Housing	**Population**	**Contact**	**Number & email**
AHEPA 113 Apartments	57 residents		937-431-0808
2300 County Line Rd.			

Beavercreek,OH 45430			
*Notes:			
Fairwood Village	80 residents		937-426-7333
1956 North Fairfield Rd.			
Beavercreek, OH 45432			
*Notes:			
Stone Manor	50 units		937-429-2313
30 Woodcroft Tr.			
Beavercreek, OH 45430			
*Notes:			
Grand Court	125 units		427-0060
280 Walden Way			
427-0060			
*Notes			
Facility – Apartment Complexes	**Population**	**Contact**	**Number & email**
AHEPA One Thirteen Inc.	57 Units		937-431-0808
2300 County Line Rd			
Beavercreek, OH			
*Notes:			
Ashton Brooke	300 units		937-427-1188
3025 Fountain Dr.			
Beavercreek			
*Notes:			
Charterwoods Apt.	307 units		937-426-3346
1570 Charterwoods Cir.			
Beavercreek			
*Notes:			

Cimmaron Woods	300 units		937-431-8160
1421 Cimmaron Cir.			
Beavercreek			
*Notes:			
Emerald Lakes Apartments	280 units		937-427-4061
2688 Diamond Cut Dr.			
Beavercreek			
*Notes:			
Fairfield Lakes	101 units		937-431-1848
2415 Hemlock Dr.			
Beavercreek			
*Notes:			
Fieldstone Apartments	108 units		937-431-5511
4451 Love Ln			
Beavercreek			
*Notes:			
Lakes of Beavercreek	212 units		937-320-9618
340 Clover Ln.			
Beavercreek			
*Notes:			
Mallard Landing Apartments	300 units		937-427-3511
2372 Mallard Ln			
Beavercreek			
*Notes:			
Meadowrun Apartments	240 units		937-429-0891
2294 Zink Rd.			
Beavercreek			
*Notes:			

Peppertree Villas	168 units		937-429-2900
1450 Spicetree Cir.			
Beavercreek			
*Notes:			
Stone Manor	50 units		937-429-2313
30 Woodcroft Tr.			
Beavercreek			
*Notes:			
Stonebridge Apartments	336 units		937-426-0271
4481 Stonecastle Dr.			
Beavercreek			
*Notes:			
Walden Village	168 units		937-429-7079
382 Walden Way			
Beavercreek			
*Notes:			
Windsor Place Apt.	72 units		937-320-1874
3944 Camberlee Way			
Beavercreek			
*Notes:			
Facility – Extreme Hazardous Substances	**Substance**	**Contact**	**Number & email**
Lowe's #89	Sulfuric Acid	Store Manager	937-427-6438
2850-I Centre Drive			24 hr: 888-429-6281
Fairborn OH 45324 USA			
*Notes:			
Qwest Communications Corp.	Sulfuric Acid	Harlan Pincus, Regional Mgr	914-686-7952
1751 Dayton-Xenia Rd			Cell: 914-420-2528
Beavercreek, OH 45385			

*Notes:			
Sams Club	Sulfuric Acid	Sara Houser, General Mgr.	W:(937) 426-1511
3446 New Germany-Trebein Rd.			24-hr:(479)273-4600
Beavercreek Ohio, 45431			
*Notes:			
The Home Depot #3855	Sulfuric Acid	Kelly Cassidy, Store Manager	W: 937-431-7346
3775 Presidential Dr.			24-hr: 937-708-1557
Fairborn OH 45324			
*Notes:			
Unison Industries	Hydrofluoric acid	Thomas Stokes	937-427-7102
2455 Dayton-Xenia Road			
Beavercreek, OH 45434			
*Notes:			
Unison Industries	Nitric Acid	Giancola, Nick, EHS Engineer	W: 937-490-7161
2455 Dayton-Xenia Road	Sulfuric Acid		C:937-469-7161
Beavercreek, OH 45434			
*Notes:			

Jurisdiction – Beavercreek Township			
Facility – Government	**Population**	**Contact**	**Number & email**
Beavercreek Township		Christy Ahrens	(937) 429-4472
1981 Dayton-Xenia Rd.			Fax (937) 429-5678
Beavercreek, OH 45434			
*Notes:			
Beavercreek Twp. Fire Department		Chief: David VandenBos	9-1-1 or 426-1213
851 Orchard Lane			fax (937) 426-8780
Beavercreek, OH 45434-7169			
*Notes:			

Station #61			937-426-1704
2195 Dayton-Xenia Rd			
Beavercreek			
*Notes:			
Station #62			937-426-0642
3777 Dayton-Xenia Rd.			
Beavercreek, OH			
*Notes:			
Station #63			937-426-0728
3100 Kemp Rd.			
Beavercreek, OH			
*Notes:			
Station #64			937-426-3854
3633 Indian Ripple Rd.			
Beavercreek, OH			
*Notes:			

Jurisdiction – Bellbrook			
Facility - Government	**Population**	**Contact**	**Number & email**
City of Bellbrook		City Manager - Mike Puckett	(937)848-4666
15 E. Franklin St.			fax (937)848-5190
Bellbrook, OH 45305			
*Notes:			
Bellbrook Police Department		Chief: Doug Doherty	9-1-1 or 848-8484
15 E Franklin St			fax (937) 848-5195
Bellbrook, OH			
*Notes:			
Bellbrook Fire Department		Chief: Jim Neidhard	9-1-1 or 848-3272

Station #21			fax (937)848-5196
35 N. West St.			
Bellbrook, OH 45305			
*Notes:			
Station #22			848-3272
4254 W. Franklin St.			
Bellbrook, OH 45305			

Appendix C

Acronyms and Definitions

Acronyms

MCOEM	Montgomery County Office of Emergency Management
GCEMA	Greene County Emergency Management Agency
OEMA	Ohio Emergency Management Agency
FEMA	Federal Emergency Management Agency
MVEOP	Miami Valley Emergency Operations Plan
ODNR	Ohio Department of Natural Resources
SFHA	Special Flood Hazard Area
FIRM	Flood Insurance Rate Map
USGS	United State Geological Survey
NCDC	National Climatic Data Center
NOAA	National Oceanic and Atmosphere Administration
NPS	National Park Service
ODPS	Ohio Department f Public Safety
MPT	Mitigation Planning Team
OBES	Ohio Bureau of Employment Services

Definitions

Aquifer: An underground geological formation able to store and yield water.

Acquisition Program: A means of purchasing property in the floodplain to demolish or relocate the structure and to convert the land to be forever maintained as open space.

Base Flood: The flood having a one percent chance of being equaled or exceeded in any given year.

Berm: A mound or wall of earth.

Buffer: A natural or vegetated area through which storm water runoff flows in a scatter manner so that the runoff does not become channelized. A buffer provides for infiltration of the runoff and filtering of pollutants.

Buyout Program: See Acquisition Program

Conservation Easement: Voluntary legal agreement between a landowner and conservation organization (government agency or land trust) that permanently limits some of the land's uses (primarily development rights).

Community Rating System (CRS): A program managed by the National Flood Insurance Program (NFIP) to provide incentives for those communities that go beyond the minimum floodplain management requirements to develop extra measures to provide protection from flooding.

Dam: A barrier constructed across a waterway to control the flow or raise the level of water.

Drainage Basin: The area of land that drains to a given point on a body of water.

Drought: An extended period with little or no precipitation; often affects crop production and availability of water supplies.

Erosion: A natural process of breaking away and moving soil or rock fragments by the action of water, wind, ice, or gravity.

FEMA: (Federal Emergency Management Agency). An independent agency reporting to the President and tasked with responding to, planning for, recovering from and mitigating against disaster.

Flash Flood: Sudden flooding cause by an intense storm dropping large amounts of rain within a brief period. A flash flood occurs with little or no warning within six hours of a rain event and can reach full peak in only a few minutes.

Flood: A large flow of water over normally dry land, especially one that causes loss or damage. The National Flood Insurance Program defines a

"flood" as a general and temporary condition of partial or complete inundation of normally dry land areas from:

(1) the overflow of inland or tidal waters; and,

(2) the unusual and rapid accumulation of runoff of surface waters from any source.

Flood Elevation Certificate: A form used to certify building elevations to ensure compliance with community floodplain management regulations, determine proper insurance premium rates and support requests for a Letter of Map Amendment (LOMA) or Revision (LOMR-F).

Flood Fringe: The land area located between the limits of the floodway and the maximum elevation subject to inundation by a100-year flood.

Flood Insurance: Federally-backed policies available to homeowners, renters and business owners that, unlike standard homeowner's insurance, covers flood damage and loss.

Flood Insurance Rate Map (FIRM): The official map of a community that marks both the special hazard areas and the risk premium zones applicable to the community. It is the map used by the Federal Emergency Management Agency to determine flood insurance rates.

Flood Watch: High flow or overflow of water from a river is possible in the given time period. It can also apply to heavy runoff or drainage of water into low-lying areas. These watches are generally issued for flooding that is expecting to occur at least six hours after heavy rains have ended.

Floodplain: The low land area adjacent to streams susceptible to being inundated by floodwaters and has a history of flooding during big storms.

Floodplain Management: The operation of an overall program of corrective and preventive measures for reducing flood damage, including but not limited to, floodplain regulations, emergency preparedness plans and flood control works.

Flood-proofing: Any combination of structural and nonstructural additions, changes, or adjustments to structures, which reduce or eliminate risk of flood damage to real estate or improved real property, water and sanitation facilities, or structures with their contents.

Floodwall: A wall made of masonry block, reinforced concrete or similar impermeable materials designed to provide protection from temporary flooding.

Floodway: The portion of the channel and floodplain of a stream or other watercourse designated to provide passage for floodwaters. The high hazard portion of the floodplain.

Floodway encroachment: Lateral limits of a floodway district along streams or other bodies of water that preserve the flood-carrying capacity of the floodway.

Freeboard: An additional amount of height above the Base Flood Elevation used as a safety factor in determining the level at which a structure's lowest floor must be elevated or flood-proofed to be in accordance with floodplain regulations.

Greenway: A linear corridor of natural floodplain that generally contain multi-use recreational trails.

Groundwater: Water found in the spaces between soil particles and cracks in rocks underground. Groundwater is a natural resource that is used for drinking, recreation, industry, and growing crops.

Impervious area: The amount of hard surfaces like rooftops, parking lots, and roads.

Levee: A man-made structure, usually an earthen dikes, designed to contain, control, or divert the flow of water so as to provide protection from temporary flooding.

Mitigation: To minimize; lessen the severity.

National Flood Insurance Program (NFIP): The program of flood insurance coverage and floodplain management created by the Federal Emergency Management Agency in 1969 as a means to have floodplain property owners build up a policy base of funds out of which future claims would be paid instead of relying on the federal government to pay for flood losses. It is administered under the Title 44 of the Code of Federal Regulations, Subchapter B.

100-year flood: More accurately referred to as a "one percent chance flood," a flood of a magnitude that statistically has one chance in 100 of occurring in any given year.

100-year floodplain: The land adjacent to a river, lake, creek or stream that has a 1 percent chance within any given year of being inundated by water during a flood.

Outfall: The place where a sewer, drain or stream discharges.

Precipitation: The part of the hydrologic cycle when water falls, in a liquid or solid state, from the atmosphere to Earth (rain, snow, sleet).

Public water: Water derived from public streets and carried into the drainage systems

Riparian: Typically, lush vegetation along a stream or river.

Runoff: Rainwater, snowmelt and other water that is not absorbed into the ground but instead flows across the land picking up pollutants and eventually runs into streams and rivers.

Sediment: Loose particles of soil and sand washed from land into waterways.

Storm drain: Constructed opening in a road system through which runoff from the road surface flows into an underground system

Stream: A general term for a body of flowing water. A natural watercourse containing water at least part of the year.

Tributary: A smaller stream that flows into a larger river, creek or stream.

Vapor: The state of water in the hydrologic cycle in which individual molecules are highly energized and move about freely; also known as gas/gaseous.

Variance: A grant of relief by a participating community from the terms of its floodplain management regulations.

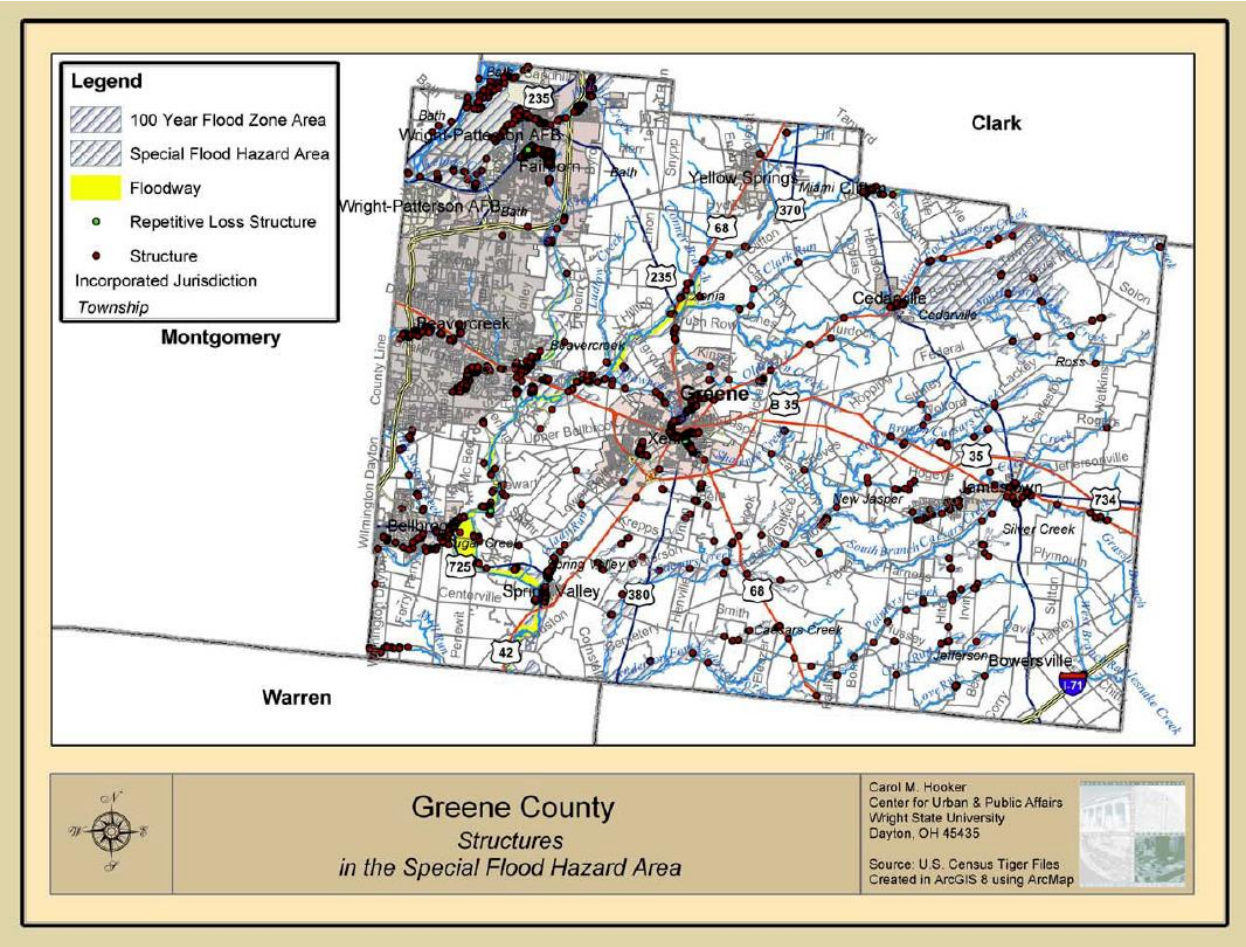
Watershed: Also called a drainage basin. The entire land area that drains water to a particular stream, channel, river or lake. Watersheds are nature's way of dividing up the landscape as every lake, pond, wetland, river, creek and stream has its own watershed (geographic area).

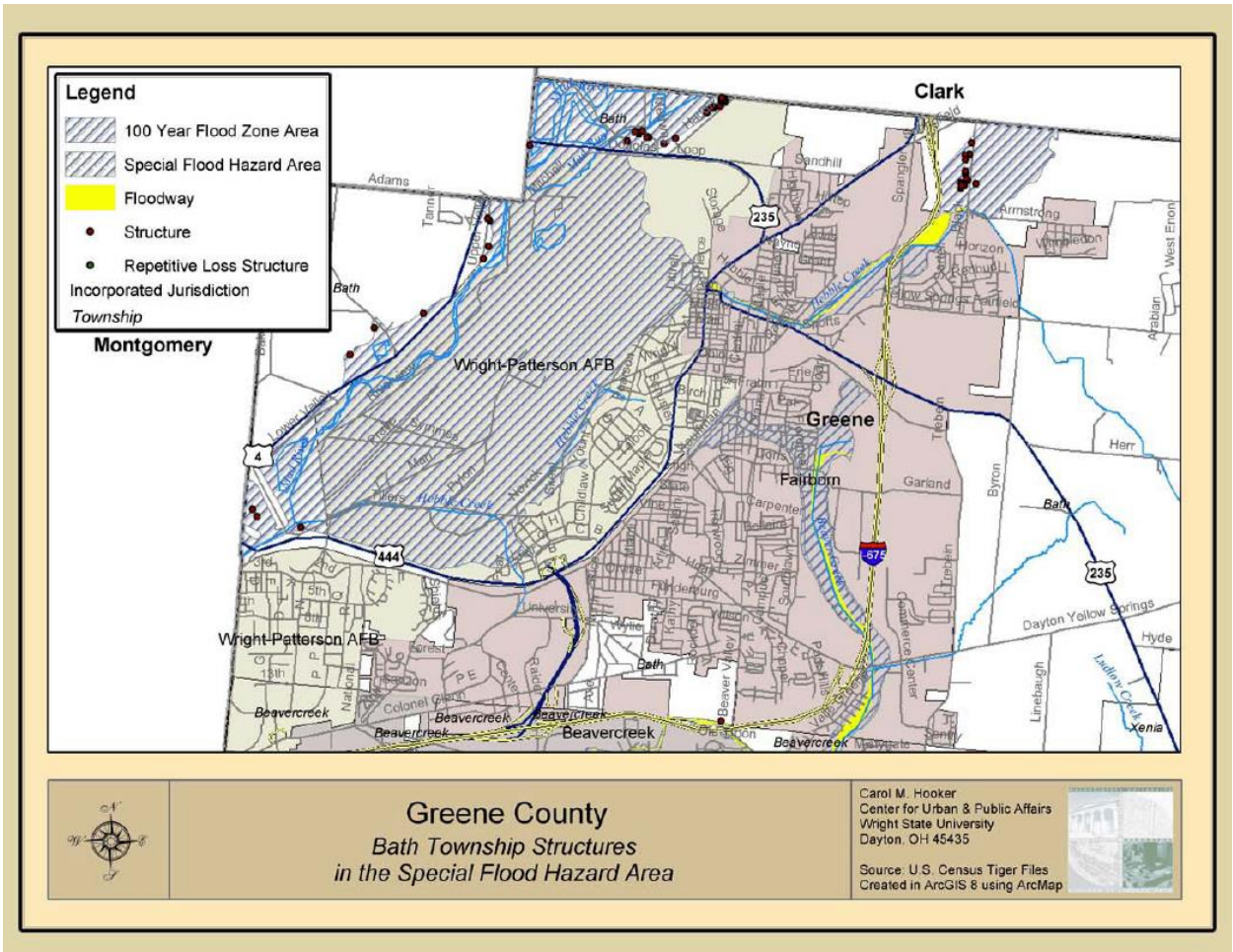
Waterway: A natural or man-made place for water to run through, such as a river, stream, creek or channel.

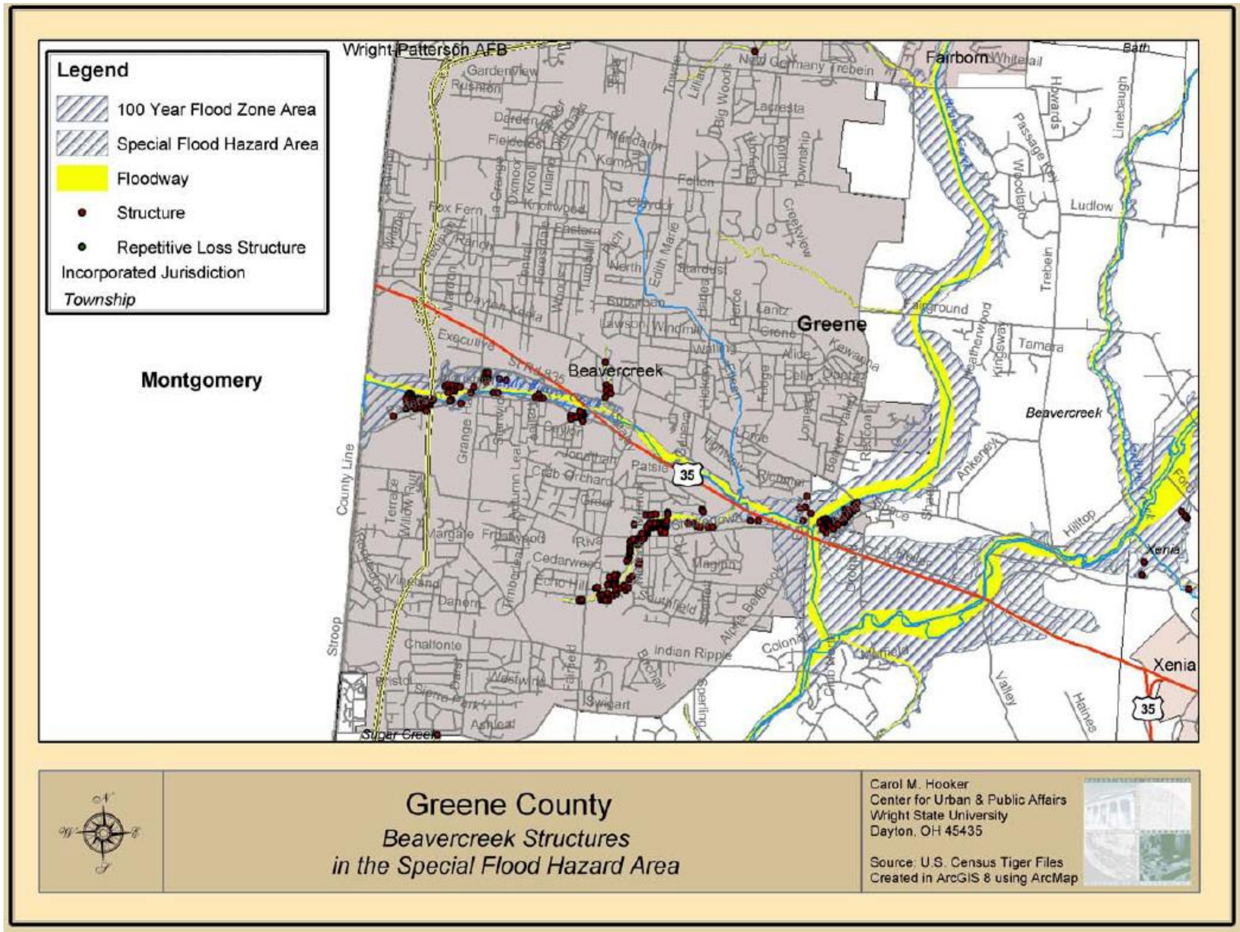
Wetland: An area of land that is regularly wet and where water saturation is the dominant factor in determining the nature of soil development and the types of plant and animal communities. Ponds and marshes are among the common names for wetlands.

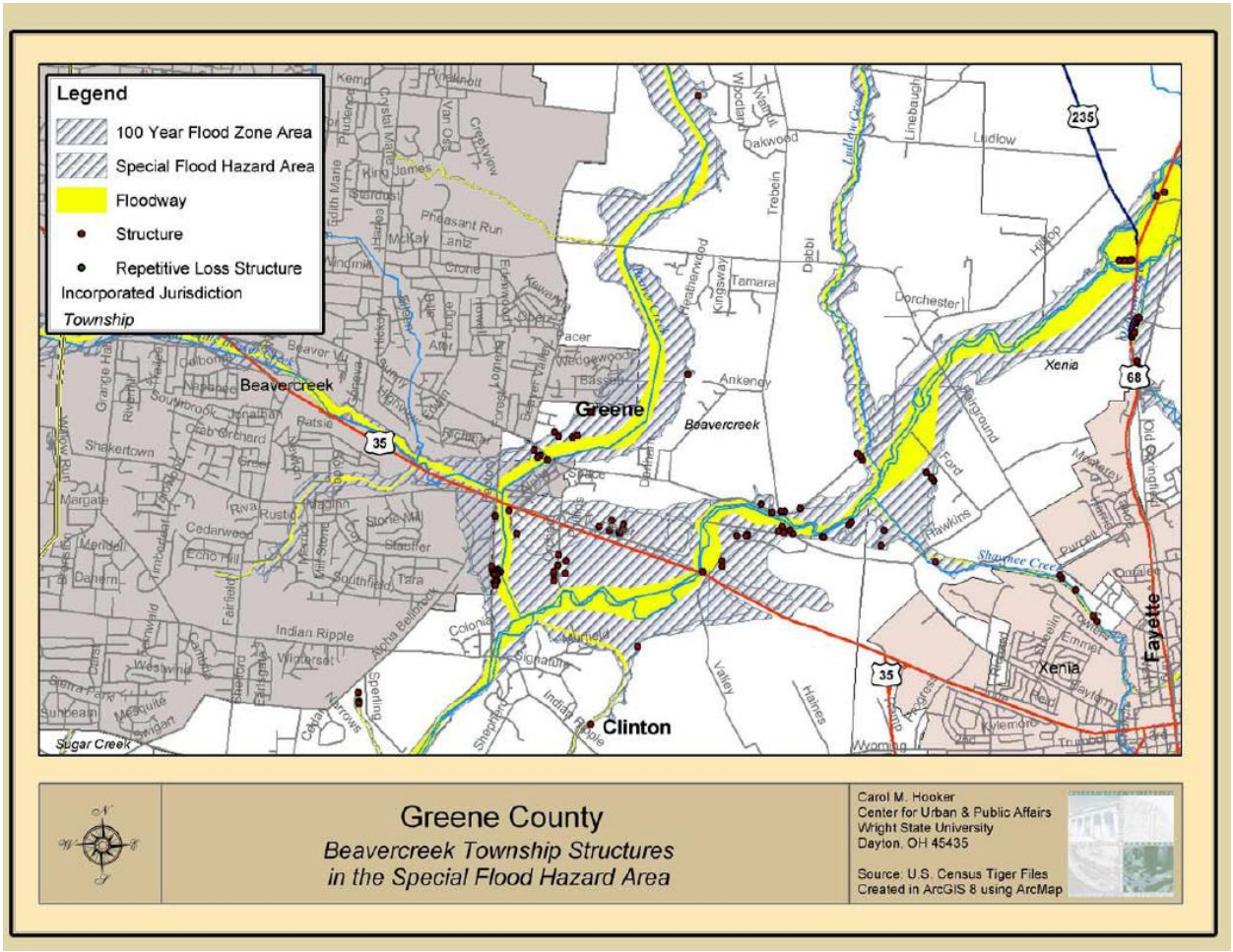
Appendix D

Structures in the Special Flood Hazard Areas




Legend
100 Year Flood Zone Area
Special Flood Hazard Area
Floodway
Structure
Repetitive Loss Structure
Incorporated Jurisdiction
Township
Clark
Montgomery
Wright-Patterson AFB
Greene
Fairborn
Beavercreek
Bath
Adams
Harmony
Sandhill
Armstrong
Horizon
Trebein
Garland
Byron
Herr
Hyde
Linebaugh
Dayton Yellow Springs
Xenia
West Enon
Arabian
Greene County
Bath Township Structures
in the Special Flood Hazard Area
Carol M. Hooker
Center for Urban & Public Affairs
Wright State University
Dayton, OH 45435
Source: U.S. Census Tiger Files
Created in ArcGIS 8 using ArcMap


Legend
100 Year Flood Zone Area
Special Flood Hazard Area
Floodway
Structure
Repetitive Loss Structure
Incorporated Jurisdiction
Township
Montgomery
Greene
Wright-Patterson AFB
Fairborn
Beavercreek
Xenia
Bath
County Line
Stroop
Ludlow
35
Greene County
Beavercreek Structures
in the Special Flood Hazard Area
Carol M. Hooker
Center for Urban & Public Affairs
Wright State University
Dayton, OH 45435
Source: U.S. Census Tiger Files
Created in ArcGIS 8 using ArcMap

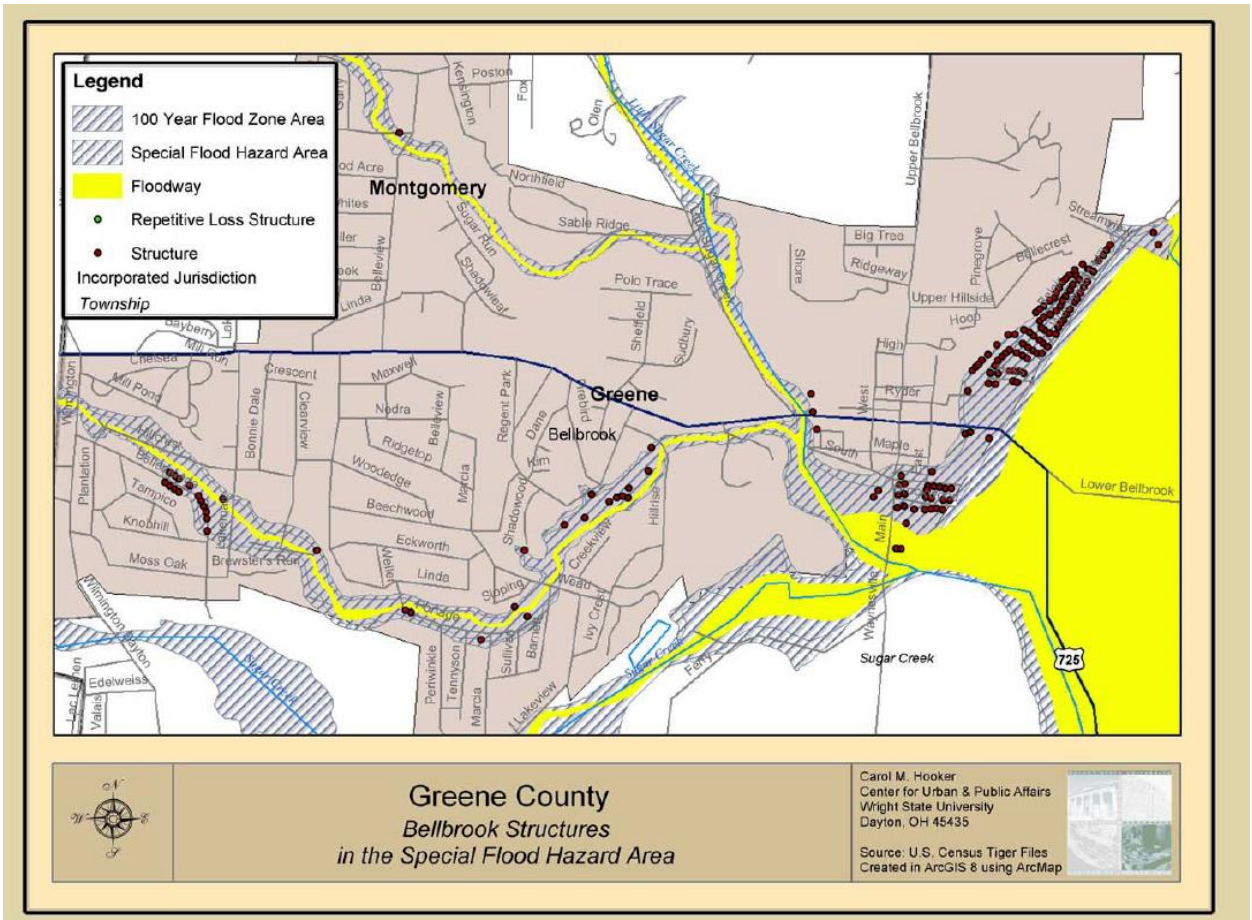


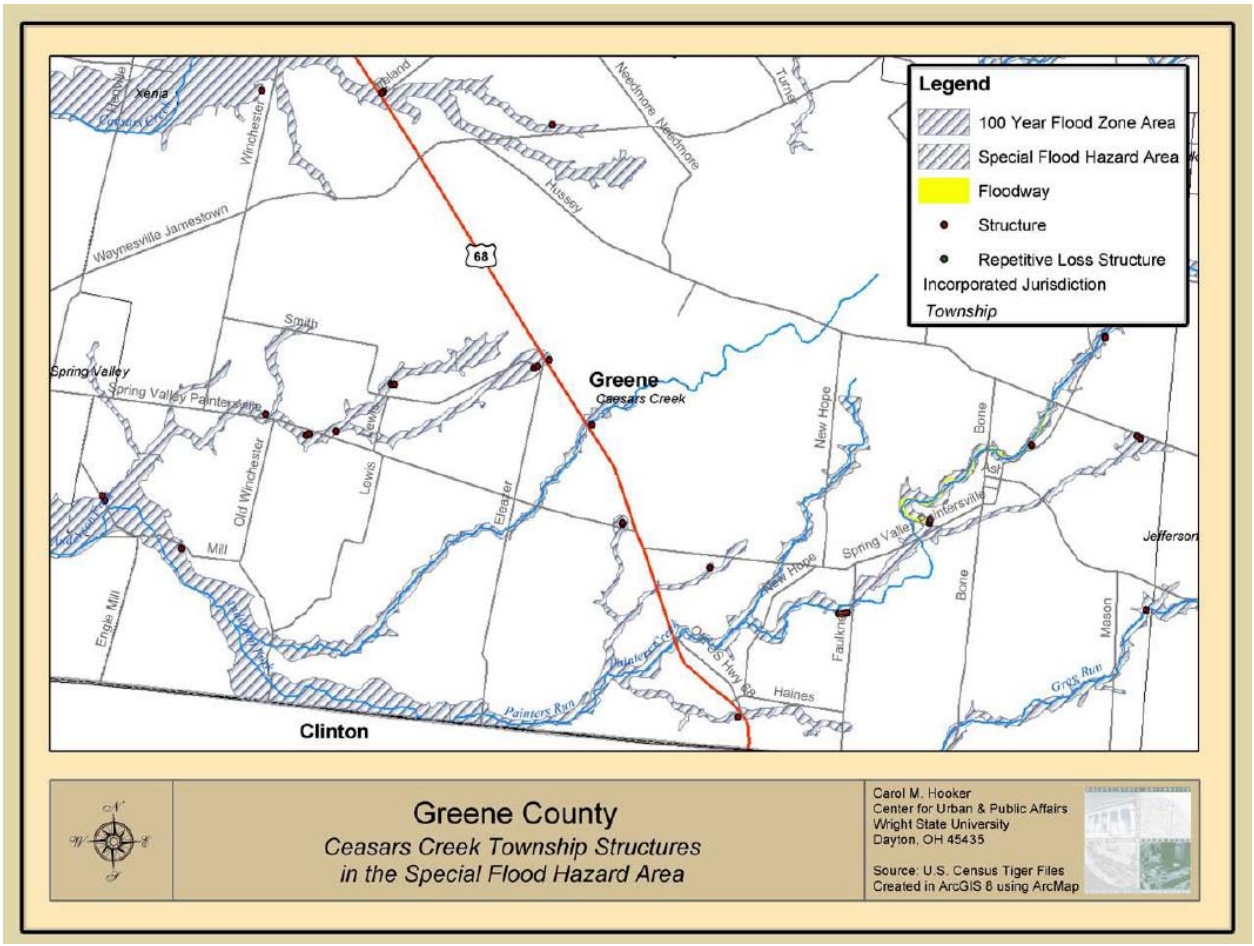
Greene County

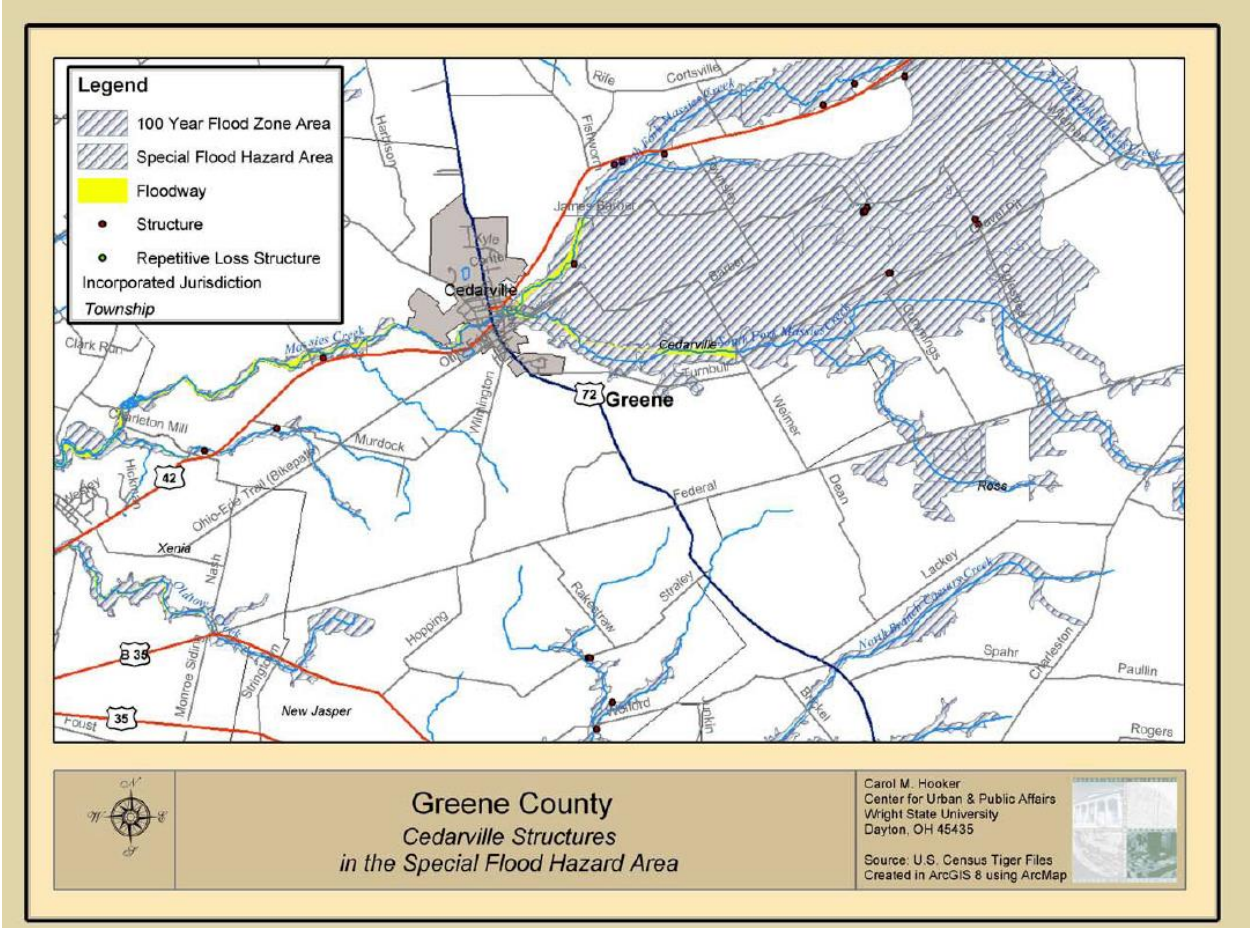
Beavercreek Township Structures in the Special Flood Hazard Area

Carol M. Hooker
Center for Urban & Public Affairs
Wright State University
Dayton, OH 45435

Source: U.S. Census Tiger Files
Created in ArcGIS 8 using ArcMap


Legend
100 Year Flood Zone Area
Special Flood Hazard Area
Floodway
Repetitive Loss Structure
Structure
Incorporated Jurisdiction
Township
Montgomery
Greene
Bellbrook
Lower Bellbrook
Sugar Creek
Greene County
Bellbrook Structures
in the Special Flood Hazard Area
Carol M. Hooker
Center for Urban & Public Affairs
Wright State University
Dayton, OH 45435
Source: U.S. Census Tiger Files
Created in ArcGIS 8 using ArcMap

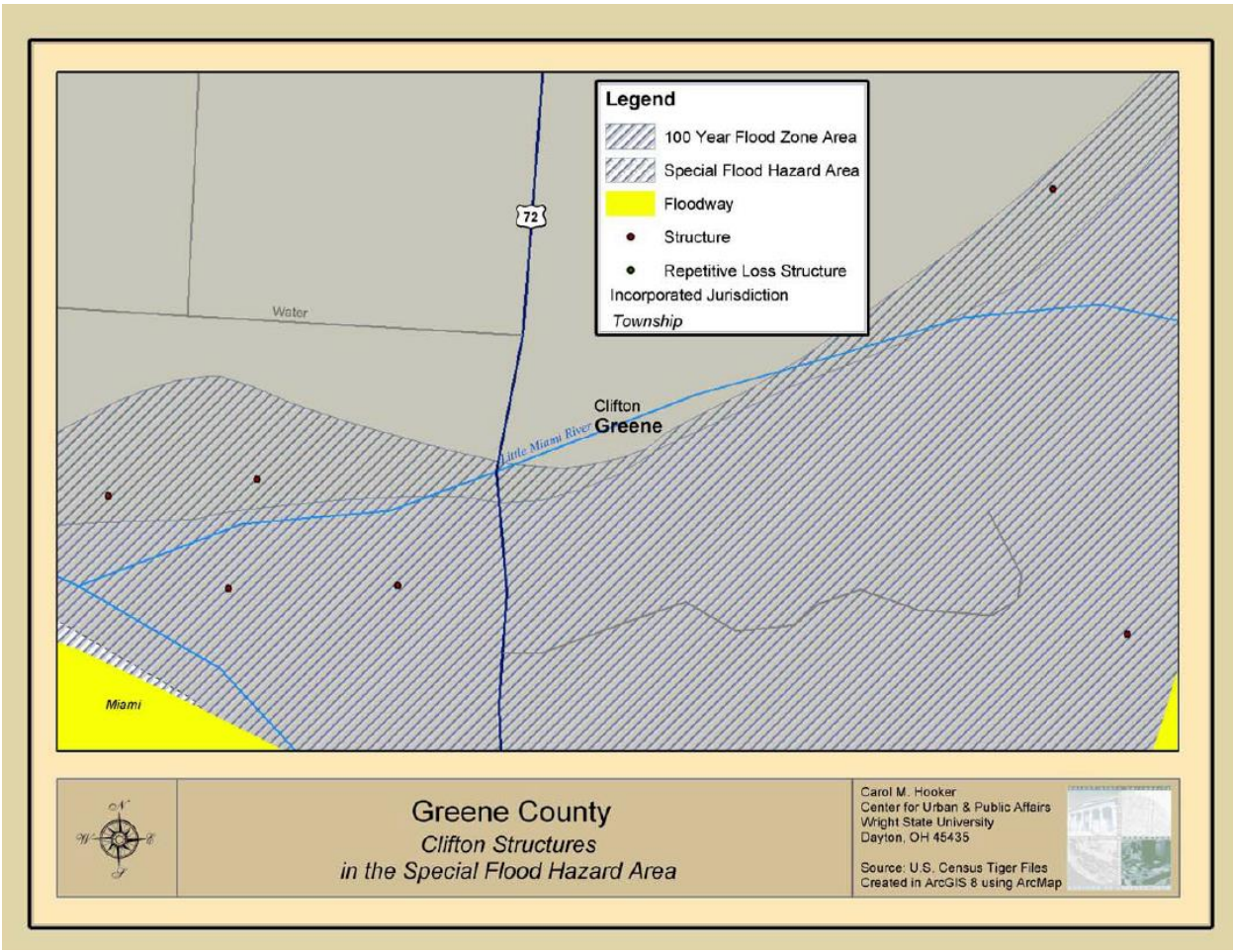

Legend
100 Year Flood Zone Area
Special Flood Hazard Area
Floodway
Structure
Repetitive Loss Structure
Incorporated Jurisdiction
Township
Xenia
Winchester
Bland
Needmore
Hussey
Waynesville Jamestown
68
Smith
Spring Valley
Spring Valley Painterville
Greene
Caesars Creek
Old Winchester
Lewis
Elbaker
New Hope
Bone
Ash
Mill
Engle Mill
Painters Run
Haines
Faulkner
Mason
Grog Run
Jefferson
Clinton
Greene County
Ceasars Creek Township Structures
in the Special Flood Hazard Area
Carol M. Hooker
Center for Urban & Public Affairs
Wright State University
Dayton, OH 45435
Source: U.S. Census Tiger Files
Created in ArcGIS 8 using ArcMap

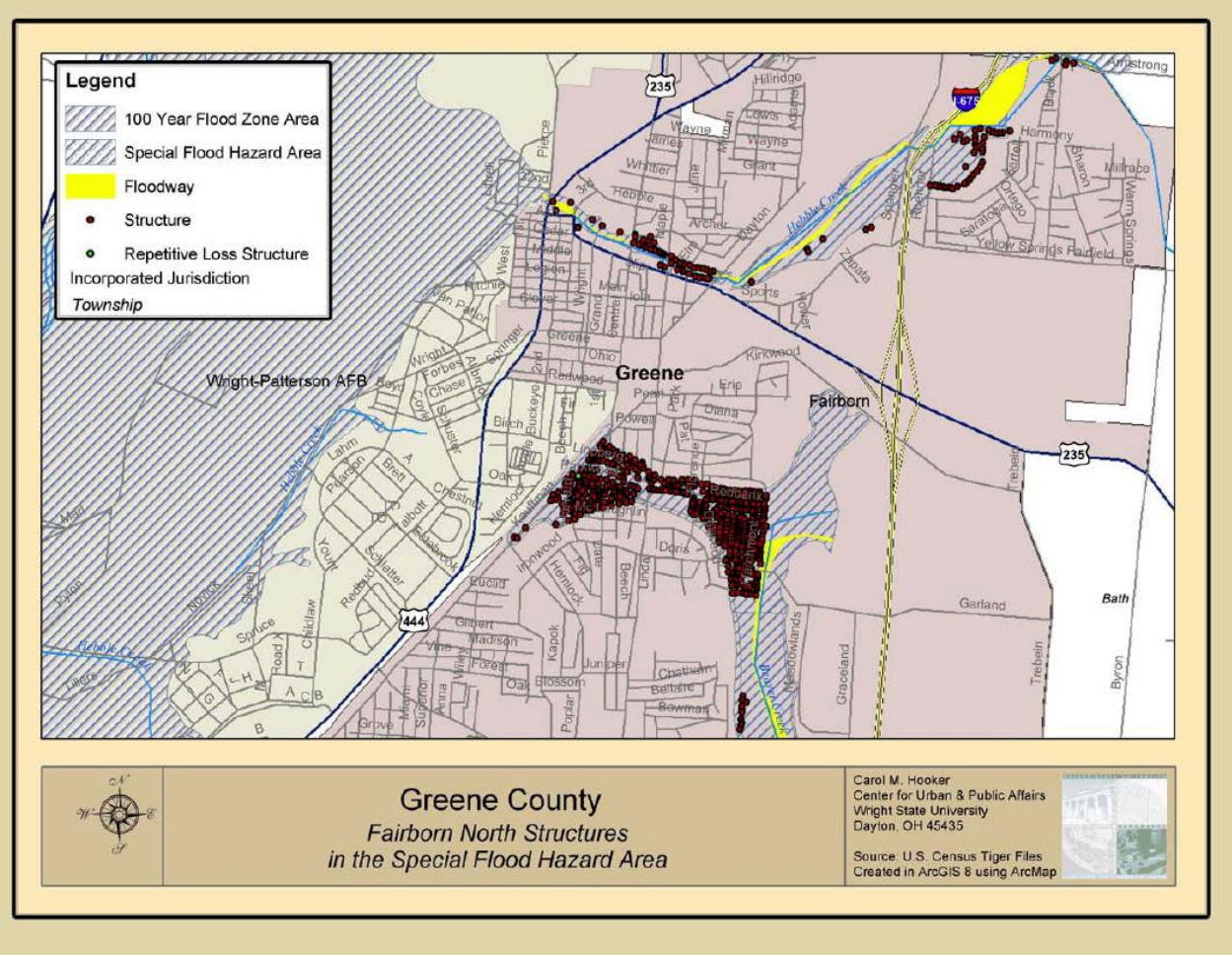


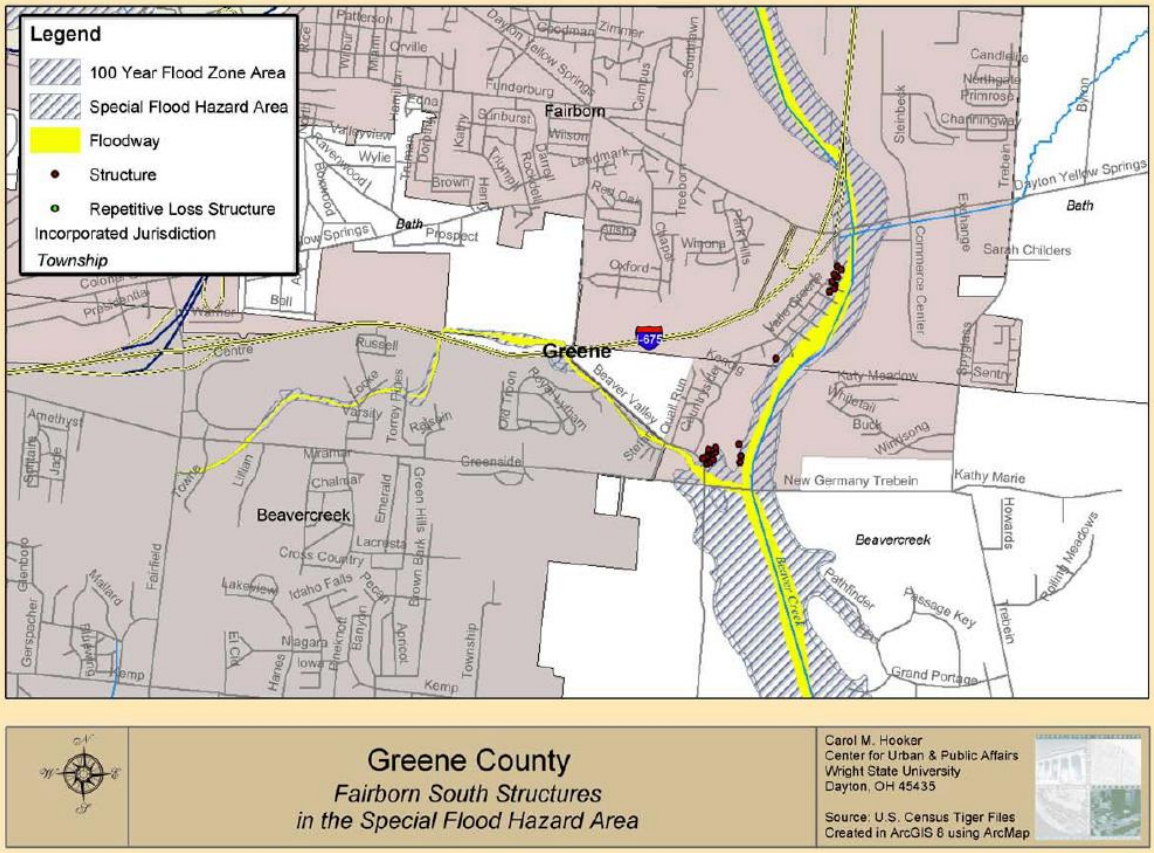
Greene County
Cedarville Structures
in the Special Flood Hazard Area

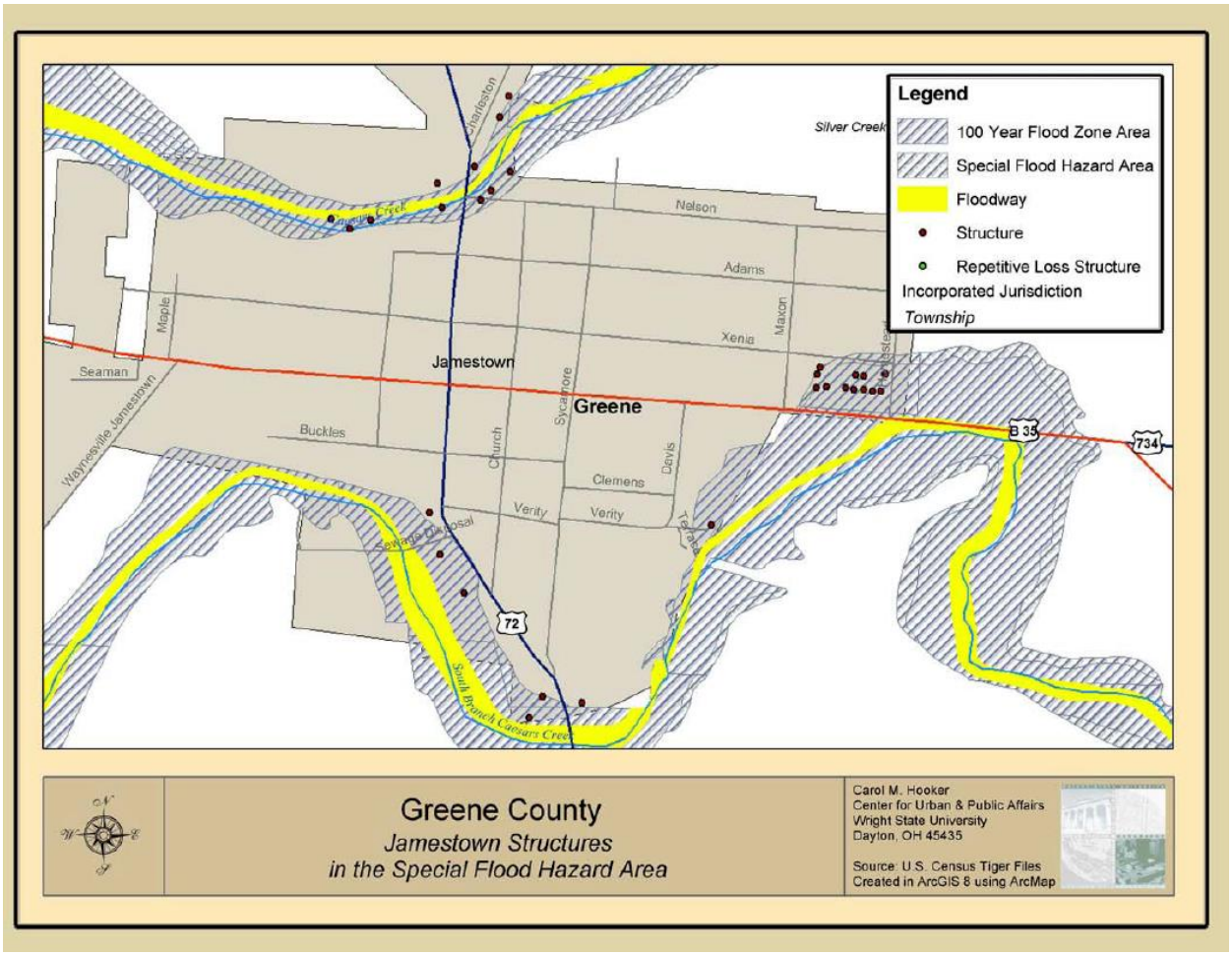
Carol M. Hooker
Center for Urban & Public Affairs
Wright State University
Dayton, OH 45435

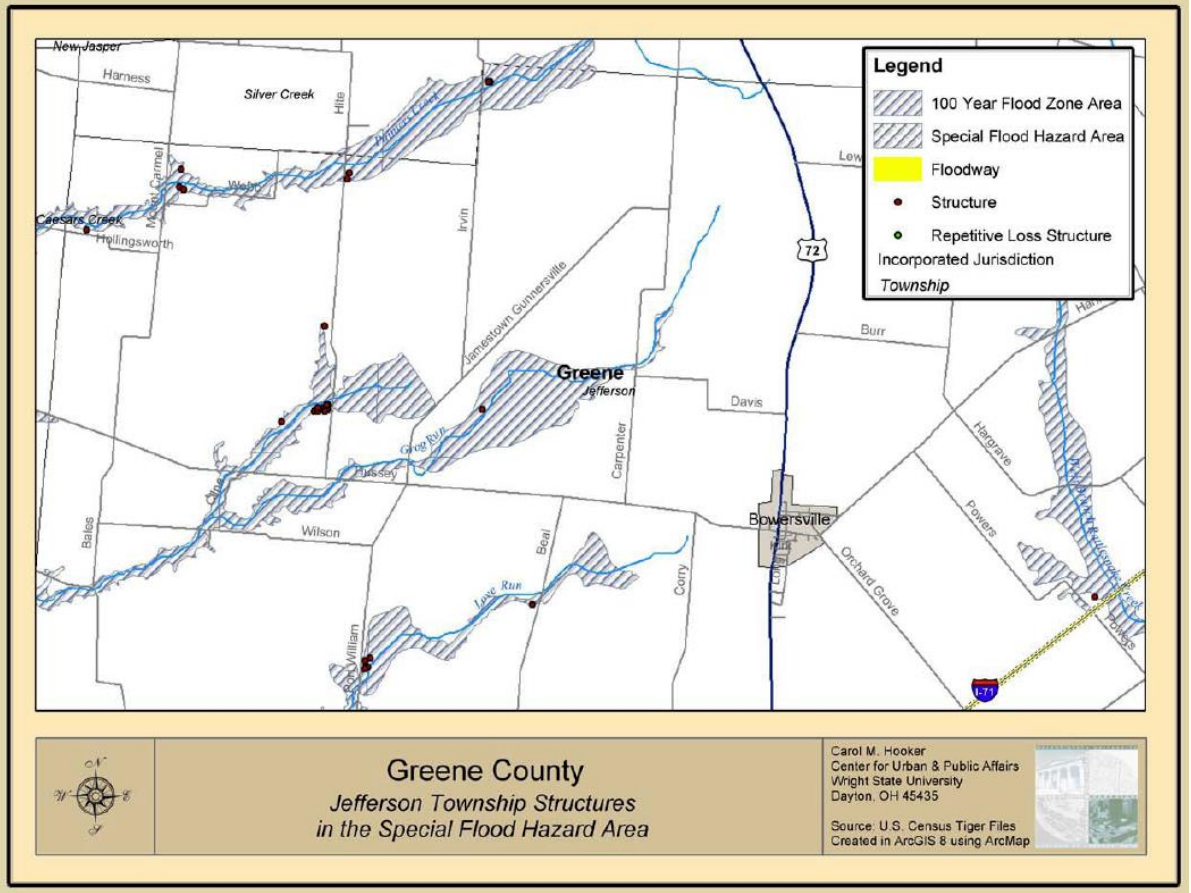
Source: U.S. Census Tiger Files
Created in ArcGIS 8 using ArcMap

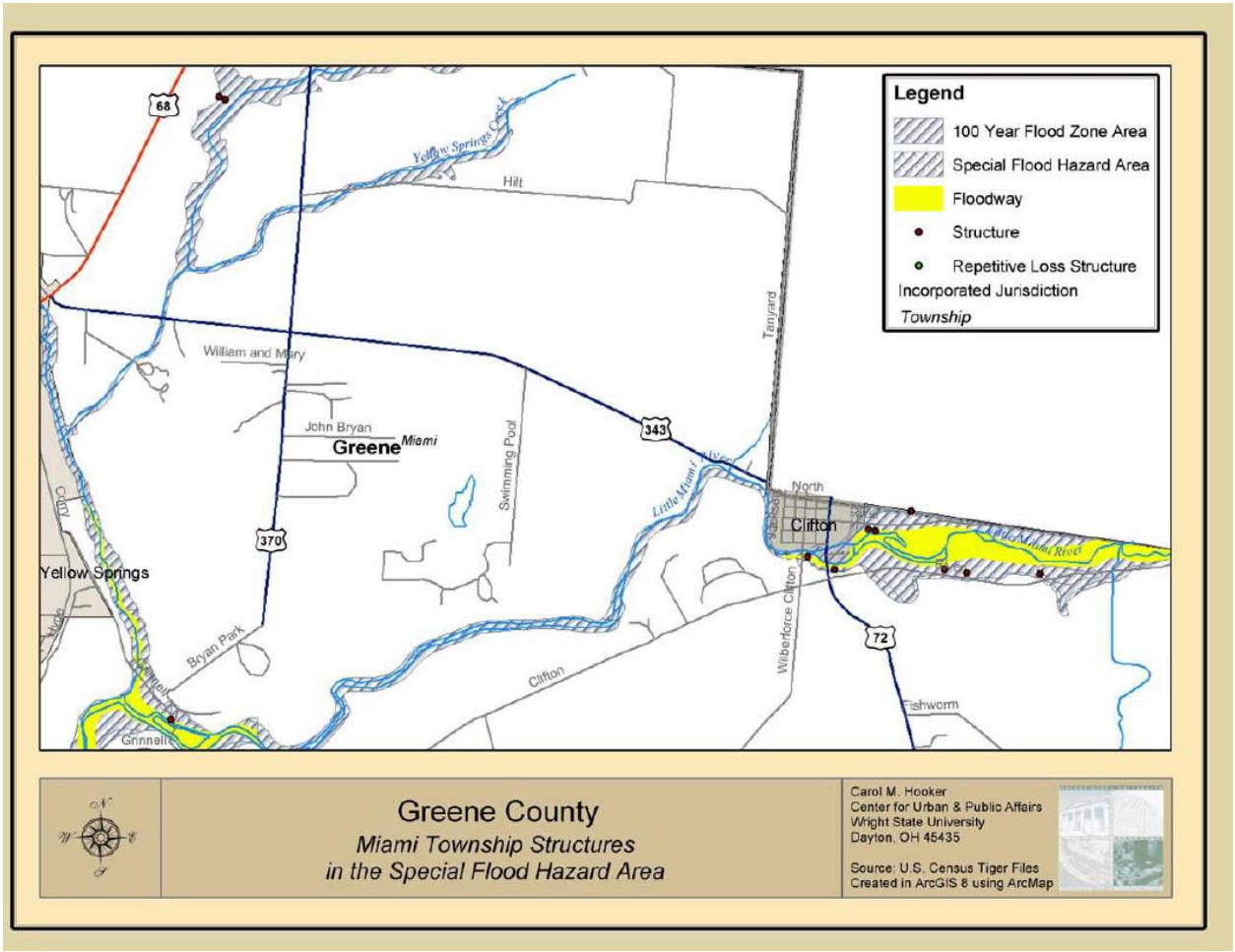

Legend
100 Year Flood Zone Area
Special Flood Hazard Area
Floodway
Structure
Repetitive Loss Structure
Incorporated Jurisdiction
Township
72
Water
Clifton
Greene
Little Miami River
Miami
Greene County
Clifton Structures
in the Special Flood Hazard Area
Carol M. Hooker
Center for Urban & Public Affairs
Wright State University
Dayton, OH 45435
Source: U.S. Census Tiger Files
Created in ArcGIS 8 using ArcMap

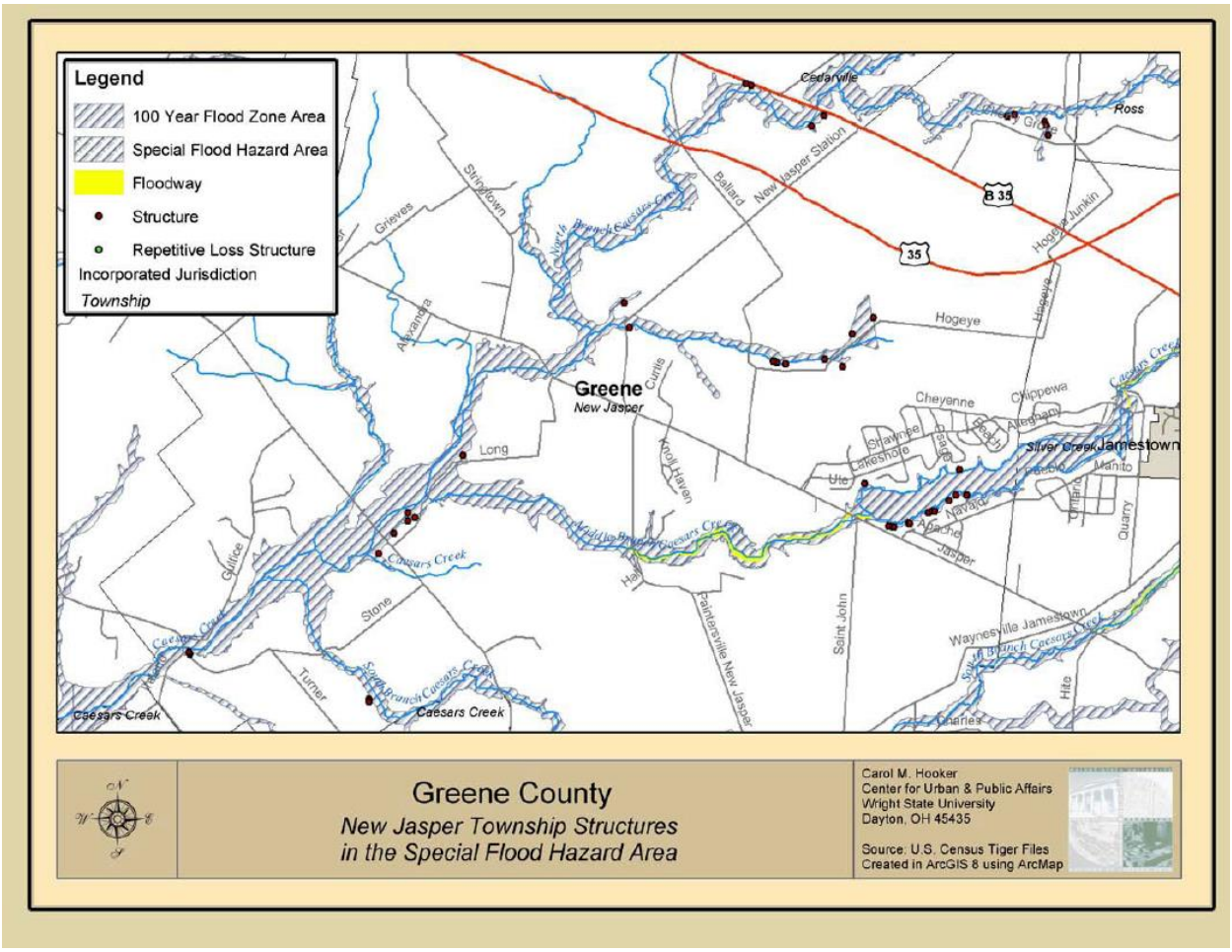

Legend
100 Year Flood Zone Area
Special Flood Hazard Area
Floodway
Structure
Repetitive Loss Structure
Incorporated Jurisdiction
Township
Greene
Fairborn
Wright-Patterson AFB
Greene County
Fairborn North Structures
in the Special Flood Hazard Area
Carol M. Hooker
Center for Urban & Public Affairs
Wright State University
Dayton, OH 45435
Source: U.S. Census Tiger Files
Created in ArcGIS 8 using ArcMap


Legend
100 Year Flood Zone Area
Special Flood Hazard Area
Floodway
Structure
Repetitive Loss Structure
Incorporated Jurisdiction
Township
Fairborn
Greene
Beavercreek
Bath
Dayton Yellow Springs
Greene County
Fairborn South Structures
in the Special Flood Hazard Area
Carol M. Hooker
Center for Urban & Public Affairs
Wright State University
Dayton, OH 45435
Source: U.S. Census Tiger Files
Created in ArcGIS 8 using ArcMap


Legend
100 Year Flood Zone Area
Special Flood Hazard Area
Floodway
Structure
Repetitive Loss Structure
Incorporated Jurisdiction
Township
Silver Creek
Nelson
Adams
Xenia
Maxon
Maple
Seaman
Waynesville Jamestown
Jamestown
Greene
Sycamore
Buckles
Church
Devis
Clemens
Verity
Verity
Terrace
B 35
734
72
South Branch Caesars Creek
Greene County
Jamestown Structures
in the Special Flood Hazard Area
Carol M. Hooker
Center for Urban & Public Affairs
Wright State University
Dayton, OH 45435
Source: U.S. Census Tiger Files
Created in ArcGIS 8 using ArcMap


Legend
100 Year Flood Zone Area
Special Flood Hazard Area
Floodway
Structure
Repetitive Loss Structure
Incorporated Jurisdiction
Township
New Jasper
Harness
Silver Creek
Hite
Caesars Creek
Hollingsworth
Irvin
Jamestown Gunnersville
Greene
Jefferson
Davis
Burr
72
Carpenter
Bowersville
Wilson
Bales
Beal
Corry
Orchard Grove
Powers
Hargrave
Dobbs
I-71
Greene County
Jefferson Township Structures
in the Special Flood Hazard Area
Carol M. Hooker
Center for Urban & Public Affairs
Wright State University
Dayton, OH 45435
Source: U.S. Census Tiger Files
Created in ArcGIS 8 using ArcMap


Legend
100 Year Flood Zone Area
Special Flood Hazard Area
Floodway
Structure
Repetitive Loss Structure
Incorporated Jurisdiction
Township
68
343
370
72
Yellow Springs Creek
Hilt
William and Mary
John Bryan
Greene
Miami
Swimming Pool
Tanyard
Little Miami River
North
Clifton
Yellow Springs
Bryan Park
Clifton
Wilberforce Clifton
Fishworm
Grinnell
Greene County
Miami Township Structures
in the Special Flood Hazard Area
Carol M. Hooker
Center for Urban & Public Affairs
Wright State University
Dayton, OH 45435
Source: U.S. Census Tiger Files
Created in ArcGIS 8 using ArcMap

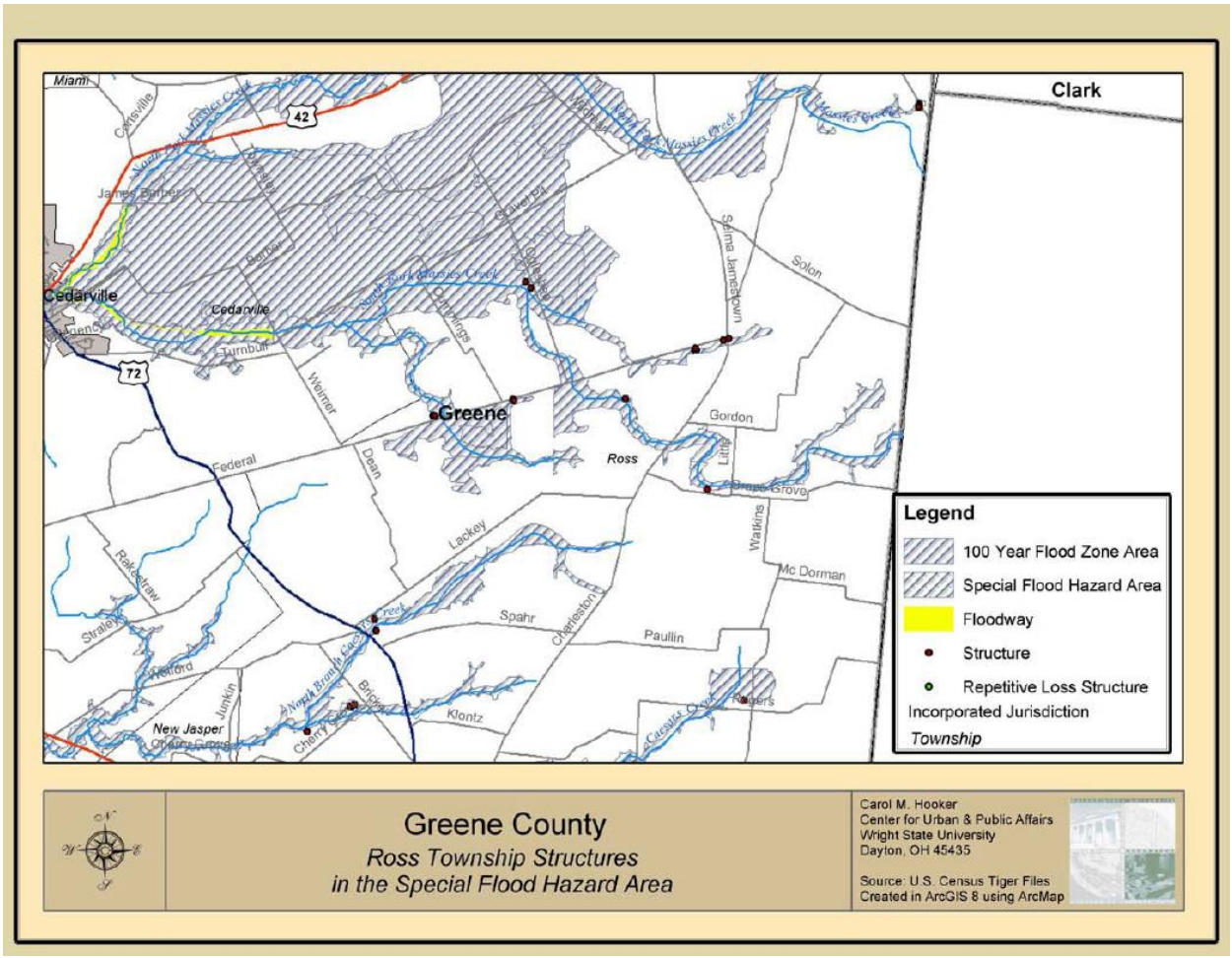


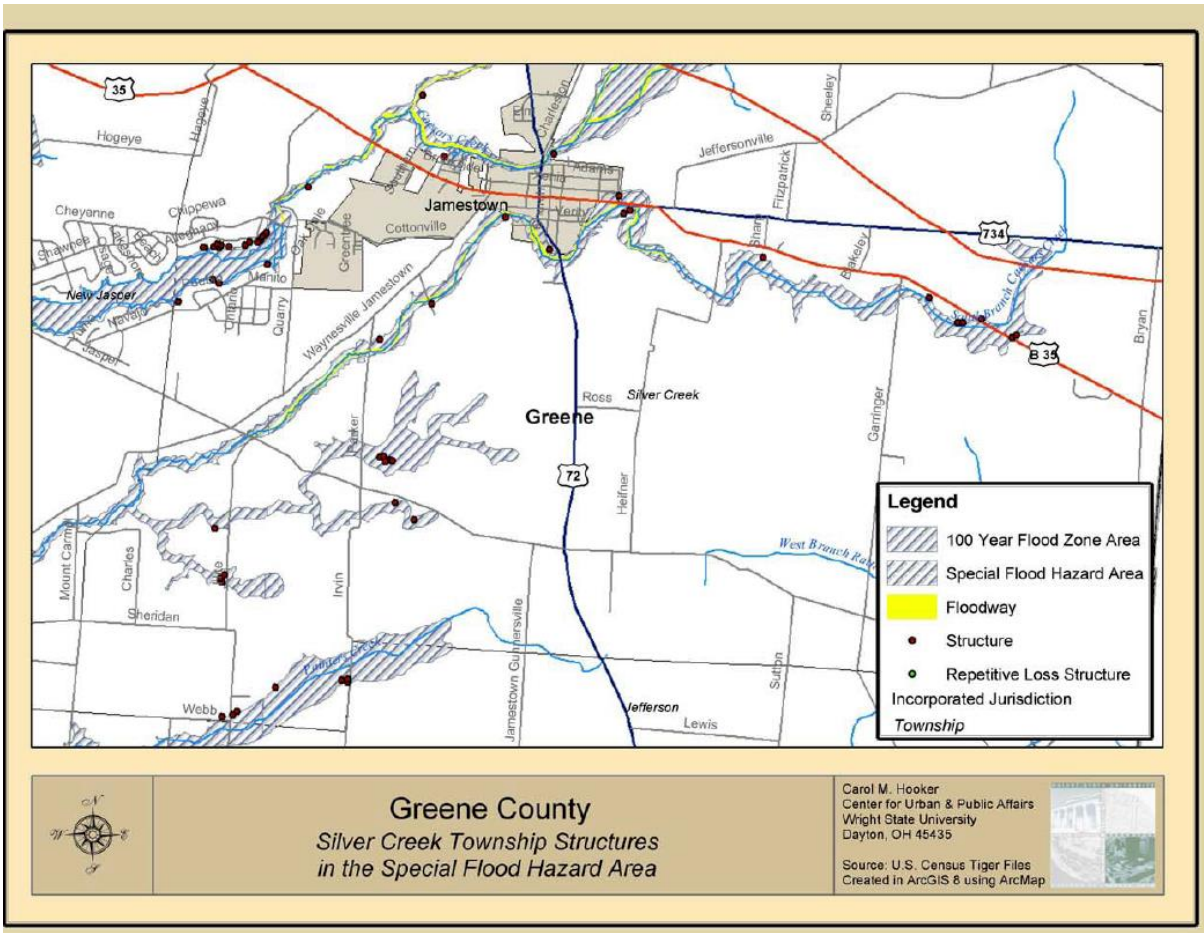
Greene County

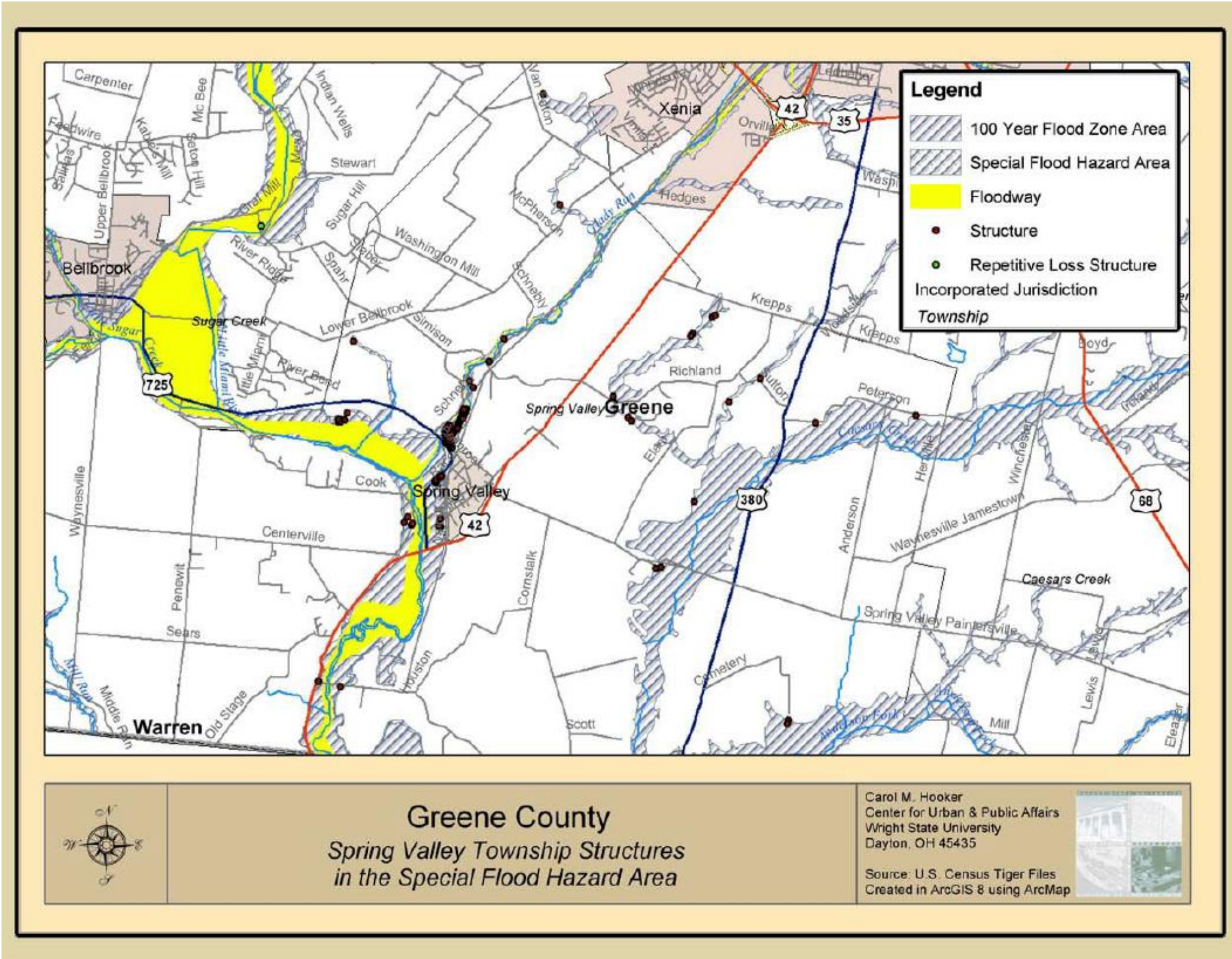
New Jasper Township Structures in the Special Flood Hazard Area

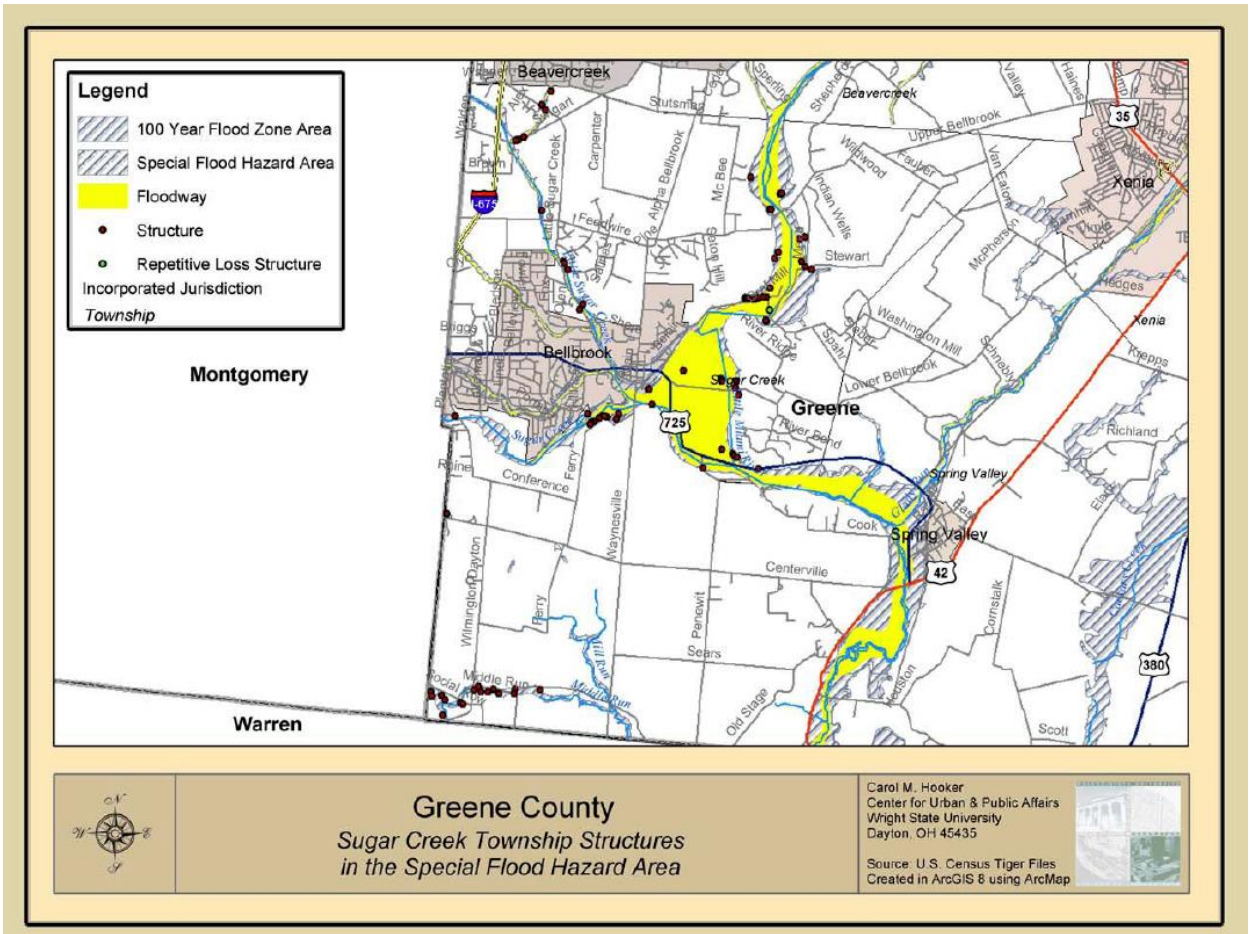
Carol M. Hooker
Center for Urban & Public Affairs
Wright State University
Dayton, OH 45435

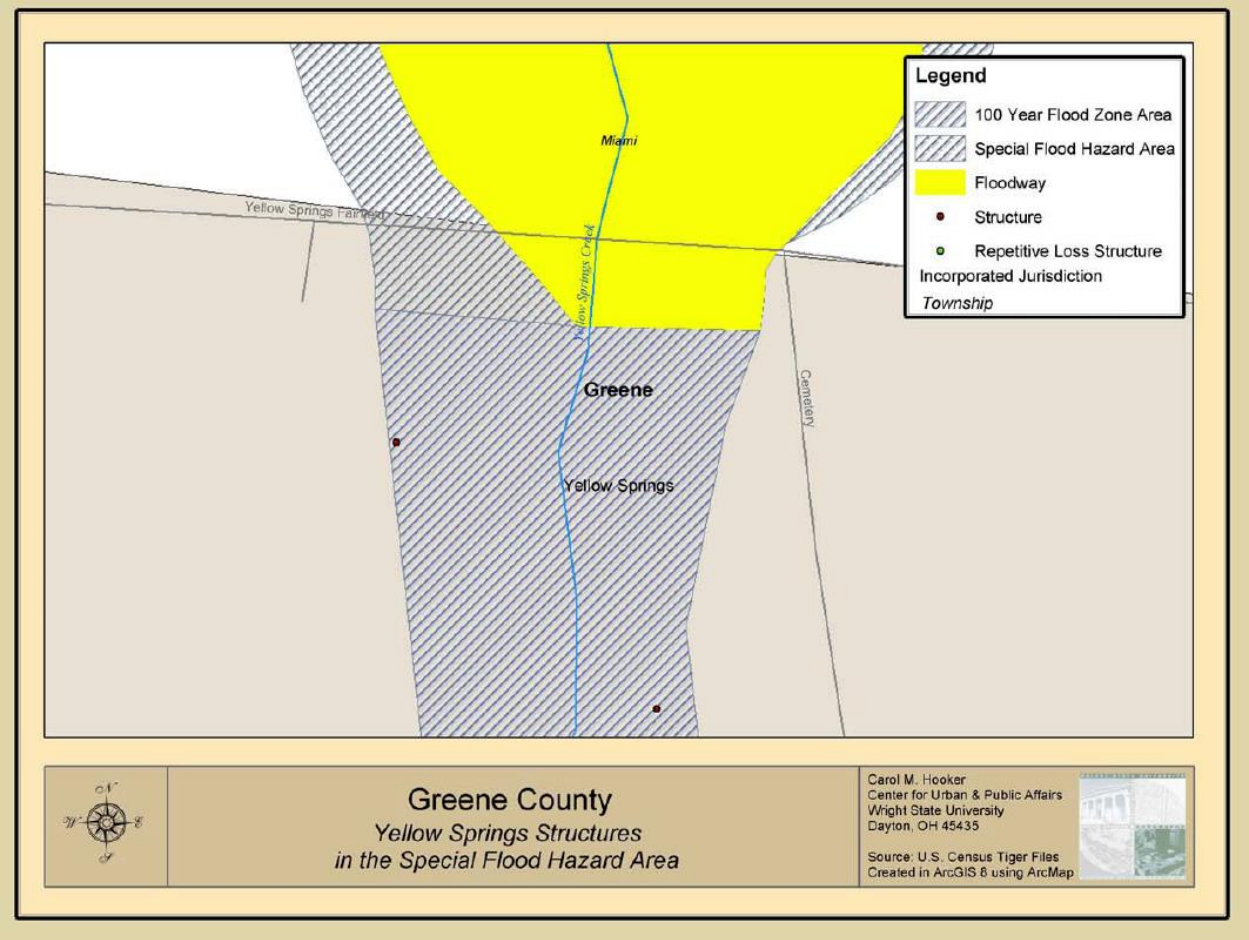
Source: U.S. Census Tiger Files
Created in ArcGIS 8 using ArcMap


Miami
Clark
Cedarville
Greene
Ross
Legend
100 Year Flood Zone Area
Special Flood Hazard Area
Floodway
Structure
Repetitive Loss Structure
Incorporated Jurisdiction
Township
Greene County
Ross Township Structures
in the Special Flood Hazard Area
Carol M. Hooker
Center for Urban & Public Affairs
Wright State University
Dayton, OH 45435
Source: U.S. Census Tiger Files
Created in ArcGIS 8 using ArcMap


Jamestown
Cottonville
Greene
Silver Creek
Ross
Jefferson
Lewis
Sheeley
Jeffersonville
Fitzpatrick
Bryan
Garringer
Helfner
Sutton
Jamestown Gunnersville
Irvin
Charles
Mount Carmel
Sheridan
Webb
Waynesville Jamestown
Quarry
Manito
New Jasper
Cheyanne
Chippewa
Hogeye
Charleston
Adams
Perry
Verity
Bakeley
Legend
100 Year Flood Zone Area
Special Flood Hazard Area
Floodway
Structure
Repetitive Loss Structure
Incorporated Jurisdiction
Township
Greene County
Silver Creek Township Structures
in the Special Flood Hazard Area
Carol M. Hooker
Center for Urban & Public Affairs
Wright State University
Dayton, OH 45435
Source: U.S. Census Tiger Files
Created in ArcGIS 8 using ArcMap


Legend
100 Year Flood Zone Area
Special Flood Hazard Area
Floodway
Structure
Repetitive Loss Structure
Incorporated Jurisdiction
Township
Xenia
Bellbrook
Spring Valley
Greene
Warren
Sugar Creek
Caesars Creek
Greene County
Spring Valley Township Structures
in the Special Flood Hazard Area
Carol M. Hooker
Center for Urban & Public Affairs
Wright State University
Dayton, OH 45435
Source: U.S. Census Tiger Files
Created in ArcGIS 8 using ArcMap


Legend
100 Year Flood Zone Area
Special Flood Hazard Area
Floodway
Structure
Repetitive Loss Structure
Incorporated Jurisdiction
Township
Montgomery
Warren
Beavercreek
Bellbrook
Sugar Creek
Greene
Spring Valley
Centerville
Xenia
Stewart
Cook
Scott
Greene County
Sugar Creek Township Structures
in the Special Flood Hazard Area
Carol M. Hooker
Center for Urban & Public Affairs
Wright State University
Dayton, OH 45435
Source: U.S. Census Tiger Files
Created in ArcGIS 8 using ArcMap


Legend
100 Year Flood Zone Area
Special Flood Hazard Area
Floodway
Structure
Repetitive Loss Structure
Incorporated Jurisdiction
Township
Miami
Yellow Springs Fairfield
Yellow Springs Creek
Greene
Yellow Springs
Cemetery
Greene County
Yellow Springs Structures
in the Special Flood Hazard Area
Carol M. Hooker
Center for Urban & Public Affairs
Wright State University
Dayton, OH 45435
Source: U.S. Census Tiger Files
Created in ArcGIS 8 using ArcMap

Appendix E

Resolutions Supporting the Plan

Resolution Example

RESOULTION # _____

A resolution to continue participation in a Multi-Jurisdictional hazard Mitigation Plan in conjunction with Greene County Emergency Management Agency.

WHEREAS, there currently exists between the (insert name of jurisdiction), Ohio and the Board of Greene County Commissioners, an agreement that the county through its Emergency Management Agency shall provide emergency management for (insert jurisdiction) in conjunction with a countywide coordinated program, and

WHEREAS, through this countywide coordinated program, Greene County Emergency Management Agency has developed a Multi-Jurisdictional Hazard Mitigation Plan that includes all hazards to which Greene County and its municipalities are susceptible as per Section 322 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, and

Whereas, goals, objectives and strategies to mitigate against the hazards that have been identified in the County, including (insert jurisdiction), have been developed, and

WHEREAS, mitigation measures for the (insert jurisdiction) and surrounding areas have been analyzed and prioritized, and

WHEREAS, Greene County stakeholders have reviewed the multi-Jurisdictional Hazard Mitigation Plan.

NOW THEREFORE, BE IT RESOLVED BY THE COUNCIL OF (INSERT JURISDICTION), STATE OF OHIO:

That this Council hereby adopts and plans to implement the actions prescribed in the Greene County Multi-Jurisdictional Hazard Mitigation Plan which is on file in the Office of the Director, Greene County Emergency Management Agency. This Resolution shall take effect immediately.

PASSED _____ SIGNED_____

(DATE) President of Council

ATTEST_____ Approved _____

Clerk of Council Mayor

Approved as to form: (name)

Law Director

(insert jurisdiction), Ohio

Appendix F

Comprehensive Land Use Plan

Development Trends

"PERSPECTIVES: 2020, A Future Land Use Plan" was prepared by the Regional Planning and Coordinating Commission of Greene County and adopted by the passage of Greene County Resolution #01-08-28-1C and the adopted by the Greene County Board of Commissioners under Resolution #02-01-10-7. Below is a summary of development trends of the county and some of the impacts in mitigation in the Planning Partnership Areas PPAs (Bath Township/City of Fairborn, Beavercreek Township/City of Beavercreek, Sugarcreek Township/City of Bellbrook and Xenia Township/City of Xenia). (Refer to Appendix F, this plan.

Perspectives, as a growth management tool set forth desired rates and types of physical, social and economic growth, as detailed within the several input documents. It represented the first land use plan that attempted to coordinate the planning efforts of all the various political jurisdictions within Greene County and presented a singular statement of how the county should develop. As previously noted, during this planning period several significant detailed updates were accomplished for municipalities and their environs: City of Xenia 1996, City of Beavercreek 1990, City of Fairborn 1991, the Village of Cedarville 1988 and the Village of Yellow Springs 1996.

In summary, actual growth and development experienced within this planning period has been substantially consistent with the tenants of the plan. The resultant land use pattern has evolved from a series of individual and corporate decisions by many actors involved in the process of community development, guided by the plan, as amended.

The future of any community has its roots in the past. Therefore, an understanding of population dynamics is at the base of almost all major planning discussion. Clearly, as a measure of the size and density of the various groups

within the county population, this basis will determine the level of demand for future facilities and services.

The following table shows the decennial population figures and corresponding changes between successive decades for Greene County during the period 1920 to 2000 with estimates to 2020. During this 100 year period, the county experienced and will experience a population growth which, when graphically reproduced, exhibits a curve, the shape of which can be segmented into three distinct sections. Greene County experienced slow but steady growth in total population, which would be expected of an agrarian area between 1920 and 1940.

As first noted in the 1950 census, the post 1940 population of Greene County experienced a phenomenal expansion in terms of both absolute numbers and rate of growth through 1970. Thus, Greene County had a 1970 population that was more than three times the enumeration thirty years earlier, and more than doubled the enumeration of the twenty years earlier.

GREENE COUNTY CENTENNIAL TRENDS, 1920 - 2020

Greene County Decennial Population Figures and Percentage Change Between Successive Decades, 1920 - 2020

YEAR	POPULATION	PERCENTAGE CHANGE FROM PRECEDING DECADE
1920	31,221	5.0%
1930	33,259	6.5%
1940	35,863	7.8%
1950	58,892	64.2%
1960	94,642	60.7%
1970	125,057	32.1%
1980	129,769	3.8%
1990	136,731	5.4%
2000	147,866	8.2%
2010	*155,300*	*5.0%*
2020	*163,065*	*5.0%*

SOURCE: RPCC after, Census of Population, General Population Characteristics, Ohio, Bureau of Census, U.S. Department of Commerce, U.S. Government Printing Office, Washington, D.C.,

1920 – 2000.

The dramatic growth of population in Greene County between 1940 and 1970 was strongly influenced by three factors: 1) dynamic growth and development of Wright Patterson Air Force Base in Bath Township, 2) the population explosion caused by the "baby boom" following World War II, and 3) the increased reliance on the automobile which, by increasing commuting distances to places of employment, resulted in a growing tendency toward suburban residency in western Greene County. This was substantially affected through out-migration from the central city in an expanding Dayton region.

The rate of growth experienced in Greene County during the period covered by Perspectives (1978) reflected a return to the rate experienced in the pre-1940 period. Although Greene County continued to capture a significant proportion of the regional population growth, this decline in growth rate was not anticipated. It can, however, be explained by two occurrences: 1) a significant decline in the growth rate of the Dayton region, and 2) a significant reduction in natural increase or births/deaths resulting in aging of the population. Unless an unforeseen expansion in the local or regional economic base occurs, there is no reason to anticipate a return to the growth rate experienced in previous planning periods.

As suggested in Perspectives, the majority of continuing urbanization in Greene County has remained in the western portions of the County. The concept of "Controlled Trends" or Urban Service Boundaries has proven successful as land uses outside urban service boundaries remain largely agriculture (See Chapter 2, Coordinated Land and Water Management Program, Urban Policies, Urban Growth Management.) Clearly, the planned provision of public utility service such as water supply and wastewater collection was linked with the planned types and location of development which are found in the existing land use pattern. In a comparison of the existing land use pattern to existing service areas highlights this reality.